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METHODS FOR PRIORITIZATION: TOWARD QUANTITATIVE APPROACH TO PRIORITIZE ZOONOSES IN SOUTH EAST ASIA

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ABSTRACT

Resources for research, surveillance, control and others public health activities are limited and it is difficult to compare the importance of diseases, which vary in terms of occurrence, impacts, etc. So, in this context of scarce resources and multiple competing priorities, it is necessary to allocate rationally human and financial resources on relevant health priorities. Prioritization is an objective tool to make the best use of limited human and financial resources for funders of research and for organizations in charge of diseases' surveillance and implementation of disease control.

In order to develop an efficient method for prioritization of zoonotic diseases in South East Asia, we performed a literature review on the different methods already developed to rank diseases. Several priority setting procedures have been used and described by various organizations (national, regional or international) and technical institutions with different models and goals. Mainly, qualitative and semi-quantitative approaches are used, in which experts are asked to score some criteria against which diseases are prioritized. Few initiatives for quantitative models have been undergone yet, mainly in the field of the food-borne diseases.

Whatever the approach used to perform the prioritization exercise, some limitations to the current developed models arise from the analysis of scientific articles and organization reports. Following the identification of weak points in the methods already applied, we discuss about the potential means that can be used to improve current models or to develop innovative tools for prioritization of zoonoses in the specific context of South East Asia.

Keywords: Prioritization, South East Asia, zoonoses

INTRODUCTION

Zoonoses represent 61% of human diseases and 75% of emerging diseases (10, 20). They affect millions of people every year either by preventing efficient production of food of animal origin, interrupting trade in animals or animal products or by directly affecting human health (23). In South East Asia, which is known to be a “hot spot” for the emergence of zoonoses (10) and where the populations living in rural areas are still largely dependent on animals for food, transport and farm work, surveillance and control of zoonoses is a main issue (17).

Regarding the fact that financial and human resources are limited, there is nowadays a general agreement at national, regional and international level that policy for prevention, surveillance and control of zoonoses must be cost-effective by focusing on the most relevant risks for both, animal and human population (2, 18, 22). Nevertheless, decision making in controlling infectious diseases is a complex, conflicting process, characterized by a mixture of epidemiological, economical and social-ethical value judgments, and priority setting becomes a multi-dimensional problem in which technical information is often intertwined with value judgments (14). In this context, in order to succeed in setting rationally priority and to make the best use of limited human and financial resources for organizations in charge of diseases' surveillance and implementation of disease control, it urged to address prioritization in a comparative and transparent manner.

Approaches to the prioritization of diseases have already been developed by various organizations (national, regional or international) and technical institutions with different models and goals. This study scans for existing approaches and methods of prioritization of diseases (not only zoonotic diseases) and analyzes advantages and disadvantages for each of them. Based on these results, we discuss about some alternatives to current methodology to improve the accuracy and the objectivity of prioritization exercise. This work should support the further development of a reproducible, standardized and transparent tool for prioritization, as an aid in making decisions for resource allocation in surveillance and control strategies of zoonoses in South East Asia.

MATERIAL AND METHODS

Necessary information to conduct this review was obtained by performing internet web searches on different sources. Initial inquiries involved visiting the websites of organizations involved in public and animal health and by checking in internet websites on items such as "prioritization/prioritisation/prioritising diseases" and "prioritization/prioritisation/prioritizing zoonoses" (www.google.com). Similar searches of peer reviewed literature were conducted using the PubMed database.

RESULTS

Developed by many organizations and technical institutions, prioritization methods have been performed to reach mainly two objectives: ranking diseases currently present or predicting the most relevant hazards for the future, regarding environmental, economical and sociological changes.

Three different approaches can be distinguished: qualitative, semi-quantitative and quantitative.

Qualitative approach

Qualitative approach has been undergone to prioritize human and animal diseases.

Eger K. *et al.* (7) use a qualitative approach for the prioritization of diseases and target groups for integrated care measures at the national level of Austria. A catalog of criteria is settled and assessed using literature review, grey literature and experts interviews. For each selected diseases, results are given in qualitative terms, as average, clear, low, high, rising, existing. An expert workshop is then organized to value the criteria and the method, according to their experience and from the perspective of the national security. Final prioritization process results in the summarize of four weighted criteria for each of the selected disease. Diseases are then classified regarding three levels of priority.

Capek *et al.* (1) use a qualitative method to prioritize non food borne zoonoses in order to allocate rationally resources for knowledge improvement, prevention and control, at the national scale of France. A preselected list of diseases is ranked regarding three criteria and using expert opinion. After discussion, a consensus is reached on categorization of diseases into three categories of different level of priority.

Semi-quantitative approach

The semi-quantitative approach has been largely used by organizations to settle a list of diseases on which surveillance and research programmes should focus on (5).

The principles use in the different methods are quite similar:

- establishing a list of diseases;
- gathering information on diseases and providing information to experts in charge of prioritization;
- establishing the relevant criteria;
- choosing a scoring system (level of scale) and an appropriate guidance on scoring to ensure transparency and reproducibility : usually scoring is realized by experts based on personal knowledge and up-to-date information provided during the workshop;
- example: for the criteria "Morbidity in human", a 5-tiered scoring system can be:
- Negligible =1 ; Low = 2 ; Medium = 3 ; High = 4 ; Very high = 5

- consideration of applying weights, to take into account the relative importance of criteria and to increase objectivity (most of the time, weighing is conducted by risk managers, independently);
- summing scores for a total score per disease;
- ranking the diseases from highest to lowest score;
- determining or not a cut-off point to allow exclusion and inclusion of diseases.

Context and characteristics of the main semi-quantitative methods previously developed are presented in Table I.

Quantitative approach

Methods based on a purely quantitative approach are still few.

Fosse J. *et al.* (8), propose a quantitative method to prioritize foodborne zoonoses due to consumption of pork and beef meat, to support decision-making in veterinary public health area. The method is based on the construction of a hazards typology and the calculation of a risk score for each selected hazards (combination of the incidence of human cases due to pork consumption and of the severity of the cases).

Kemmeren *et al.* (11) developed a quantitative model to help Dutch decision makers to establish the priority of pathogenic micro-organisms that can be transmitted by food, as a basis for effective and efficient policy-making on control, prevention and surveillance. The hierarchic classification of diseases is based on the quantitative assessment of the burden of the disease and the cost of illness using outcome tree for each pathogen. The estimation the disease burden and the cost of illness is proceeded using an incidence approach, i.e. calculating the present expected sum of current and future costs accruing to all incident cases of disease in a specific time period, taking into account age-specific disease risk and related illness costs.

Havelaar *et al.* (9) work on a general method to prioritize pathogens in order to support the development of early warning and surveillance systems of emerging zoonoses in the Netherlands. The quantitative method is based on a multi-criteria method that allows to combine objective information on the epidemiology and societal impact of zoonotic pathogens with subjective information on the relative weights of different criteria. The risk score is based on seven epidemiological and societal criteria that cover the complete pathway from introduction to societal impact of the diseases. Authors decided to restrict the number of criteria to avoid the challenge to develop complex validated databases.

Table I : Semi-quantitative methods for diseases prioritization

Reference	Country/organization/year	Objectives	Nb of disease	Nb of criteria	Scoring system	Weighting system	Collecting opinion methodology	Nb of participants	Type of participants
Doherty *et al* (6)	Canada, Center for diseases control, 2000	Surveillance strategy for human diseases	43	10	3, 4 and 5-tiered	No	Subcommittee on communicable diseases	non available	Epidemiologists of the subcommittee
Perry *et al.* (16)	ILRI, 2002	Setting priorities for animal health research in developing countries		5	5-tiered	Yes (economic impact scale)	Workshop	non available	International experts

Dubrovnik pledge (21)	World, WHO, 2002	Surveillance of infectious diseases	53	8	5-tiered	No	Delphi method	24	Epidemiologists of member countries
RIVM emerging zoonoses (5)	Netherlands, RIVM, 2006	Risk management of emerging zoonoses	-	9	4-tiered	Yes (relative to perceived threats)	Consortium	-	-
WHO guidelines on setting priorities (19)	World, WHO, 2006	Diseases surveillance with changing needs	-	5 to 8	5-tiered	Ranking of the criteria	Workshop + 1 facilitator	-	-
DEFRA Veterinary surveillance (5)	United Kingdom, DEFRA, 2006	Animal health and welfare policies	25	40	3-tiered and 5-tiered	Relative weight	Workshops	23 national organizations	Governmental and non-governmental stakeholders
Mc Kenzie *et al.* (15)	New Zealands, Massey Univ., 2007	Surveillance strategy of wildlife pathogens	82	3	4-tiered	No	Electronically	-	Wildlife disease experts project team members
ETPGAH (5)	EU, ETPGAH, 2007	Risk assessment to develop new tools for control	46	24	5-tiered	No	Workshop + questionnaires	30	Academia, Industry, Regulators, Users
European Chief Veterinary Officers (3)	EU, DG SANCO, 2008	Risk management of animal-related threats	-	34	5-tiered	Yes	CVO working party	11	CVOs
Krause *et al.* (13)	Germany, RKI, 2008	Epidemiological research and surveillance	85	12	3-tiered	Yes	Delphi	11	Epidemiologists and infectious diseases specialists of RKI
Cardoen *et al* (2)	Belgium, Federal Agency for the safety of food chain, 2009	Surveillance strategy for food and waterborne diseases	51	5	5-tiered	Yes (risk managers)	Working group	35	Scientific experts (animal and public health, food, clinical microbiology and epidemiology)

DISCUSSION

Qualitative approach is a quick and simple tool, easy to communicate to decision makers. However, all the methods described previously are very subjective and show a lack of repeatability and transparency, and so can lead to important bias in the ranking of the disease.

Semi-quantitative approach increases transparency and repeatability comparing to the qualitative approach, but developed methods remain subjective and arbitrary (12, 14). There is no objective basis to combine highly divergent criteria on the same scale and then simply add up or multiply all scores (11) and linear relation between the different scales of a criterion or between criteria are often assumed but not supported by data (9). The choice of the criteria against which the prioritization is performed remains a weak point in most of the studies although it is determinant for the performance of the method. Firstly, it is crucial for criteria to be accurate and clearly labeled to be sure that they are understood the same way by all the users. Secondly, the choice of the criteria needs to be relevant regarding the context in which the prioritization exercise is performed and the objective which is aimed to be reached. But it is very challenging to be exhaustive in the list of criteria to be sure to assess all the accurate components of the disease, without being redundant (12) to avoid introduction of major biases in the final result of the ranking. Some methods attempted to improve the differentiation between the diseases by increasing the number of scale in the scoring system. However, the difficulty to generate clear definitions for each scale increases with the number of scale and there might not be sufficient detailed information available for many diseases and criteria to allow such a differentiated approach (12). Furthermore, all the criteria do not have the same importance when undergoing a prioritization exercise and so, a relative weight needs to be applied to them (13). For the approaches in which a weighting system is applied, it commonly persists a lack of transparency and objectivity in the way the weight are attributed to criteria. Finally, most of the methods require inputs from expert group for the scoring of the criteria. There is thus a high risk that the answers of the experts are biased by their individual professional focus and so that there is an important part of subjectivity in the final result of diseases ranking (13).

Quantitative approach is less arbitrary that semi-quantitative approach as the criteria are scored using natural values or associated numerical scale. Also, all criteria are weighed in proportion to their true values, instead of on arbitrary numbers and so the final ranking result is expected to be more accurate and realistic (14). A disadvantage is that the process is very resource intensive, requiring careful consideration of a large volume of data while many data gaps may exist. Such data gaps result in uncertainties about the final results, but the quantitative approach also helps to prioritize among data needs and to identify key research questions. To avoid the complexity to gather a large amount of data, methods use a restricted number of criteria. Even if the authors tried to reach a high level of integration in the choice of the criteria to cover the wider range of features, they may miss some components of the diseases that are useful to be assessed to fully achieve the objective of their study. Nevertheless, according to Cox *et al.* (4), simple quantitative models will often be more accurate and useful than qualitative risk rating, while requiring no more information than would be needed to assess, justify, and interpret qualitative rating.

A summary of principles, advantages and disadvantages of the three different approaches is presented in Table II.

Therefore, regarding the previous literature study, three main approaches have been initiated to prioritize diseases but with some limitations: qualitative approach which is subjective and unreliable to support accurate models; semi-quantitative approach which leads to reproducible but still arbitrary models; quantitative approach which is more transparent and objective but need a high amount of data. Qualitative approache should not be to support prioritization of diseases, even if, according to Cox *et al. (4)*, qualitative models can be reliable if diseases are categorized into clusters prior to the prioritization exercise. Regarding semi-quantitative approach, the accuracy of current methods could be improved by combining the classical scoring with a probabilistic method. The use of probability distributions instead of single value for score and weight allows to take into account uncertainty and variability and may improve the differentiation between diseases without increasing the number of scales. The choice of the criteria and the weighting system associated is a cornerstone of prioritization exercise, especially in semi-quantitative approach. Elicitation of expert opinion on the choice of the criteria and on the weighting system associated should be an appropriate option to gain in objectivity and transparency in the choice of the weighted criteria. Nevertheless, expert opinion elicitation should be avoided for the scoring process of the criteria, as the scores given by experts may be biased by individual professional focus. Quantitative approach is not currently well developed and only applied to prioritize a few number of preselected diseases on the base of a little number of criteria. This approach appears to be the most objective one but needs a large amount of quantitative data that are not always available or require a lot of resources for their gathering. So, improving

the data collection and dealing with data missing (quantification of the uncertainty of the results caused by insufficient data) should allow to use the quantitative approach to prioritize a large number of diseases on the base of a wide range of criteria.

Table II: Overview of the three main approaches for diseases prioritization

	Qualitative approach	Semi-quantitative approach	Quantitative approach
Principles	Weighting and combining qualitative data about diseases	Scoring of criteria according to a scale , ± weighting of the criteria, summing score	Natural value associated to each criteria, ± weighting of the criteria, aggregation
Advantages	Quick and simple tool Easy to communicate	Quick and easy tool Acceptable transparency and accuracy	Transparent, objective
Disadvantages	High subjectivity level Lack of transparency and repeatability High risk of bias in the ranking	Subjectivity of scoring (expert opinion) Arbitrary scale of criteria and weighting system	Heavy to perform Requirement of large amount of data

CONCLUSION

Prioritization is an efficient tool that can be used as an aid in making decisions for resource allocation in different areas, as surveillance and control strategies and key research questions formulation. Nevertheless, methods for prioritization need to be transparent, standardized and repeatable to be efficient in setting priorities. Up to now, various models have been developed, experimenting different approaches, but it still remains some room for improvement in the design of such tools and a strong need to adapt them to the special context of zoonoses in South East Asia. Whatever is the improvement that can be bring to semi-quantitative approach, it appears important to continue to develop and apply quantitative methods for prioritization of diseases as they are the most reliable and robust tools (4, 9, 12).

In the context of prioritization of zoonoses in South East Asia, two major characteristics need to be taken into account when developing a prioritization method. Firstly, when talking about zoonoses, the frame of the study is located at the interface between human, animal and environment. So, the choice of criteria should allow to assess diseases against a wide range of components (epidemiological features, animal and public health impact, socio-economical impact of the disease). Thus, in the specific case of zoonoses prioritization, the challenge to be relevant and non redundant in the selection of the criteria is a main point. Secondly, when addressing the problem of disease prioritization in developing countries, the objective of the prioritization exercise may be different from the one of the methods developed until now for developing countries, and thus the choice of the criteria as well as the scale against which they are scored may not be appropriate. The approach to develop tools for prioritization in South East Asia needs to consider the socio-economical characteristics of the region and so, the objective of the prioritization exercise, as well a the criteria to support it, have to be carefully defined in order to comply with the expected needs of the countries in the area. The problem of availability of data to support semi-quantitative and quantitative models will be a main constraint and so, collection of data may be a cornerstone in the success of developing efficient prioritization tools for zoonoses in South East Asia.

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NATIONAL INITIATIVES FOR ANIMAL AND HUMAN HEALTH SECTOR COLLABORATION FOR THE PREVENTION AND CONTROL OF ZOONOSES IN THE PHILIPPINES

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ABSTRACT

Since 2008, the Department of Agriculture (DA) through the Bureau of Animal Industry (BAI) had been working closely with the Department of Health (DOH) on establishing a sustainable coordinating mechanism between the animal and human health sectors in the prevention and control of zoonoses. This undertaking was made possible through the initiative and support of the Food and Agriculture Organization (FAO), World Organisation for Animal Health (OIE) and the World Health Organization (WHO). All are now working together under the global concept of "One Health". In the seeming events of emerging diseases like Nipah Virus, Severe Acute Respiratory Syndrome, Highly Pathogenic Avian Influenza, Ebola Reston in pigs, and Pandemic Influenza (H1N1) 2009, there is now a strong impetus to concretize more collaborative efforts between the animal and human health sectors to control zoonotic diseases and to safeguard public health. This move will not only address emerging zoonoses but also endemic zoonoses plaguing the country as well (e.g. Rabies, Anthrax, Leptospirosis). As part of government efforts, a Zoonosis Technical Working Group (TWG) has been formed from the DA, DOH, and recently, the Department of Environment and Natural Resources (DENR) to address a more coordinated zoonoses control at the animal-human-ecosystems interfaces. At the DA, the BAI takes the lead for animal health along with the National Meat Inspection Service to cover food safety. At the DOH, the National Center for Disease Prevention and Control leads in human health while