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Stakeholder prioritization of zoonoses in Japan with analytic hierarchy process method

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SUMMARY

There exists an urgent need to develop iterative risk assessment strategies of zoonotic diseases. The aim of this study is to develop a method of prioritizing 98 zoonoses derived from animal pathogens in Japan and to involve four major groups of stakeholders: researchers, physicians, public health officials, and citizens. We used a combination of risk profiling and analytic hierarchy process (AHP). Profiling risk was accomplished with semi-quantitative analysis of existing public health data. AHP data collection was performed by administering questionnaires to the four stakeholder groups. Results showed that researchers and public health officials focused on case fatality as the chief important factor, while physicians and citizens placed more weight on diagnosis and prevention, respectively. Most of the six top-ranked diseases were similar among all stakeholders. Transmissible spongiform encephalopathy, severe acute respiratory syndrome, and Ebola fever were ranked first, second, and third, respectively.

Key words: Japan, prioritization, stakeholders, surveillance, zoonoses.

INTRODUCTION

In 1897, Japan first implemented its Communicable Diseases Prevention Law [1, 2], but a century passed before it was updated with the Infectious Disease Control Law, enacted in 1999 [3]. The original focus 100 years earlier was only on infectious diseases between humans, but the new law included animal-derived infectious diseases of people for the first time.

After 5 years of establishment of the Infectious Disease Control Law, the first semi-quantitative risk analysis was conducted, which resulted in measures being put in place to control the importation of exotic animals such as all Chiroptera (bats) and rodents of the *Mastomys* genus (the natural hosts of Lassa fever). Previously, four million animals had been imported annually. Most (88%) of them were designated for use as pets, which represented a substantial risk to human exposure over the others, which were listed as livestock. The imported pets included dogs and cats, skunks, foxes, and other animals. High-risk exotic animals were put under special investigation and stopped being imported.

The new regulations and related practices (increased jobs at quarantine facilities, addition of animals and diseases to the restricted lists) reduced the numbers of these potential carriers of disease. Comparing 2003 figures to those of 2000, the number of imported mammals and birds were reduced by 60%

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and 87%, respectively. As a result, these measures were deemed successful for mitigating most external risks due to exotic animal importation.

The objective of iterative risk assessment of zoonotic diseases is to ensure appropriate allocation of scarce resources to surveillance and/or controlling the highest-risk diseases. Once such measurements are successfully implemented, it is necessary to evaluate and monitor the effect of those measurements using a combination of risk assessment methods and surveillance strategies. Depending on the results year to year, risk ranking would routinely be altered (raised or lowered), and annual reviews would be conducted to revise control measurements. Risk management of some diseases would accordingly be ranked higher while others would be downgraded based on risk assessment. However, we cannot deal with all infectious diseases at the same time; we must focus primarily on the high-risk diseases. Therefore, there is a need to prioritize zoonoses on a regular basis because government budgets are limited, and there are not enough well-trained epidemiologists and other experts in various fields of emergency preparation and in predicting/avoiding the worst pandemic.

We are now at a stage of devising a systematic/iterative risk profiling of zoonotic diseases for adjusting updated situations in Japan. Our description here and in the Discussion is not meant to be a comprehensive review or comparison of methods, but it highlights major relevant papers on the subject.

Based on a comparison of prioritization methodologies spanning a decade of research, Krause *et al*. [4] concluded that a dearth of uniformity existed over a large number of factors in the risk-profiling approach. Despite this, and with additional information by Mangen *et al*. [5], Ng & Sargeant [6] stated, 'it is agreed that risk-based priority should be systematic, empirical and quantitative, easy to implement, based on good science, transparent, flexible, reproducible and informative to public policy'. To meet these reasonable standards and to more clearly define the perceived risk priority of the pathogens, we employed a combination of risk profiling and analytic hierarchy process (AHP) methods [7, 8] on our list of initially identified diseases.

AHP and conjoint analysis (CA) methods have been compared by Mulye [9] and Meibner & Decker [10]. Both methods involve identifying the diseases for prioritization and labelling criteria, followed by ranking of the criteria. Mulye's study [9] suggested that AHP outperformed CA in complex problem situations. Results from two experiments showed opposite results regarding predictive validity of either method. Mulye conceded, however, that 'for pragmatic reasons, the questioning procedure in conventional AHP seems easier to respond to'. Meibner & Decker [10] showed the superiority of AHP over a choice-based CA (CBC) in making market predictions because AHP involved choosing between only two items instead of three.

AHP is useful in quantifying subjective topics, and provides a simple method (pairwise comparison) that is easy for participants to understand, and the hierarchical structure gives reviewers a clear picture of the importance of criteria. In choosing AHP, we involved scientific, government, medical, and non-technical (local citizens) persons in the prioritization process. Ease of use was paramount, as described by Mulye [9], especially for the non-technical raters, but even for people with some measure of technical knowledge, such as government public health officials and general physicians. In addition, all three of these may not be accustomed to any formal prioritization process in their careers. Meibner & Decker [10] further supported the use of AHP by stating that respondents 'would be more motivated' despite it taking slightly longer than CA; they pointed out that the choice tasks are more enjoyable in AHP and that respondents with CA surveys might suffer from 'information overload'.

Various stakeholders will undoubtedly hold slightly or significantly different viewpoints on the importance and usefulness of disease prioritization data ([6] and references within). For example, citizens, medical doctors, veterinarians, researchers, politicians, and quarantine officials put different emphases on the value of risk assessment data. Their responses to disease risks (including associated actions such as preventive measures and announcements) and to outbreaks will vary depending on their roles in society, and also in how they perceive the situations. In addition, their responses may have further interrelated roles in society. The general public, for instance, might react by contacting individuals in any of the other mentioned groups to voice concern, fear, outrage, or demands related to changes in the way information is conveyed, taxes are spent, treatment or prevention is offered, etc. As stated by Ng & Sargeant [11], the scientifically 'expert groups acknowledge their priorities may not reflect the priorities concerning the general public or decision makers, particularly under social or political pressure'. Humblet *et al*. [12] felt similarly and employed a multidisciplinary group to evaluate their list of animal diseases and zoonoses in Europe. The group consisted of epidemiologists, veterinary officers, academic experts on societal aspects of diseases, and other experts in agricultural economics, animal welfare, and biodiversity. They did not, however, include the general public. Therefore, it is important for all those concerned to be provided with a transparent evaluation of the constantly changing situation with respect to zoonotic diseases [6, 11], so that everyone can make their own judgements and act accordingly.

Based on the above, and because there may be cultural, social, and political differences between countries that influence the perceptions and decision-making processes of the general public, government offices, and scientific community, the chief aim of this paper is to describe our method and present a prioritization list of the most important zoonoses in humans for the following stakeholders in Japan: researchers, physicians, public health officials, and citizens.

Table 1. *Definition of criteria and sub-criteria with analytic hierarchy process (AHP) weights based on absolute measurement*

Criteria	Sub-criteria	AHP weight
1. No. of human cases/ year (incidence)	>13 000 000*	1
	130 000–13 000 000	0·73006
	13 000–130 000	0·51534
	1 300–13 000	0·33742
	130–1 300	0·21779
	30–130	0·16258
	<30	0·10123
2. Human-to-human spread	Occurs very much	1
	Occurs somewhat	0·258367
	Does not occur	0·080321
3. Case fatality rate	>10%	1
	1–10%	0·508772
	0–1%	0·251462
	<1%	0·122807
	Negligible	0·064327
4. Availability of diagnostic test	None	1
	Limited	0·230668
	Everywhere	0·079948
5. Treatment	Unavailable	1
	Symptomatic therapy only	0·346648
	Specific method available	0·079886
6. Preventive methods	None	1
	Non-specific†	0·248677
	Vaccine available	0·074074
7. Frequency of entry to Japan	Indigenous	1
	Once in 3 years	0·524911
	Once in 10 years	0·185053
	Once in 100 years	0·067616

* Total population of Japan ≈130 million.
† Disinfection and heating only.

METHODS

Selecting zoonotic diseases

We reviewed the scientific literature (e.g. WHO, FAO, resources from the Ministry of Health and other agencies) with the aim selecting important zoonotic pathogens in Japan. After deliberations, a group of 98 zoonotic diseases was identified.

Prioritization methods: risk profiling and AHP

Risk profiling

Criteria selection. The subsequent risk profiling of the 98 diseases was conducted in a semi-quantitative way as follows. Ultimately, seven parameters (criteria) were identified to assess the risk of each pathogen (Table 1). To do this, initially, authors discussed among themselves which criteria should be included in order to rank the diseases. Five criteria – incidence (number of new cases recorded in Japan per year), preventive method, treatment type, case fatality rate (severity, consequence), and existence of diagnostic test – were chosen because they can describe characteristics of a disease caused by the respective pathogen. Based on these five criteria, we created a preliminary version of risk profiles, which was then further examined by 76 members of the Association for Human and Animal Common Infectious Diseases using a questionnaire. They suggested including two more criteria: human-to-human transmission and frequency of entry into Japan. The latter of these was added because the parameter 'incidence' referred only to reported cases in Japan in one year from agents already present. Frequency of entry was deemed necessary for pathogens that had not been recorded in the country (such as avian influenza), and the term 'indigenous' simply signifies the mathematical extreme of entry as being commonplace, as opposed to the other values which refer to the 'exotic' nature or rarity.

Risk sub-criteria. Each of the above criteria has unique risk sub-criteria, as shown in Table 1 and in

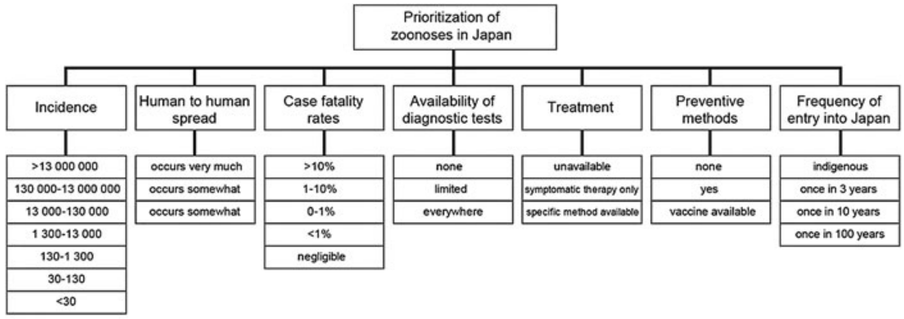

Fig. 1. Hierarchy structure: analytic hierarchy process (AHP) risk profile model for researchers.

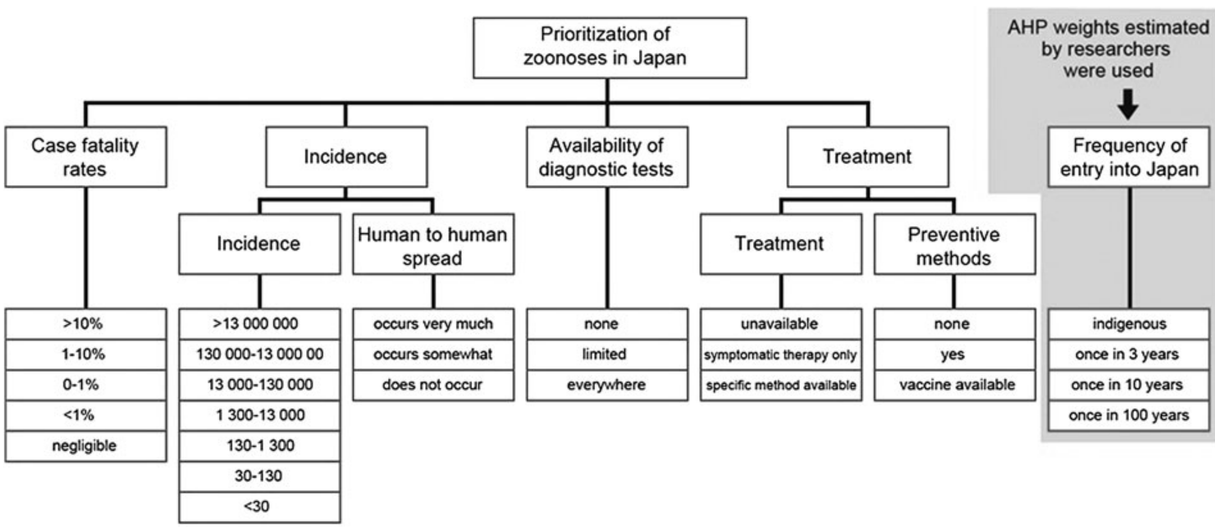

Fig. 2. Hierarchy structure: analytic hierarchy process (AHP) risk profile model for physicians, public health officials, and citizens.

hierarchical structure in Figure 1. The authors then determined the associated weights of the sub-criteria using the AHP absolute evaluation method (Table 1). Absolute evaluation method assigns a value of 1 to the worst-case scenario, and with pairwise comparison within a criteria group, subsequent values are smaller for the better situations. These calculations were performed from the authors' pairwise comparison values with ASHtools.xls (an Excel file which was downloaded from http://www.ohmsha.co.jp/data/link/4-274-06616-9/index.htm [13]).

Stakeholder ranking (pairwise comparison with AHP)

The AHP weights of each zoonosis were then evaluated by Japanese researchers, physicians, public health officials and citizens. Again, pairwise comparisons were made, but this time it was performed on the seven criteria, not the sub-criteria. Since we recognized that conducting pairwise comparisons with seven criteria simultaneously was complicated and confusing (it required 21 comparisons), we modified the original survey used by researchers and created another simpler style for physicians, public health officials, and citizens with fewer ($n = 8$) pairwise comparisons (Fig. 2). The four groups were administered their respective AHP surveys as described below. Therefore, only researchers estimated AHP weights on frequency of entry into Japan. Once again, AHStools.xls was used to perform the calculations from data obtained from stakeholders.

The data for each of the four stakeholder groups were analysed separately. First, individual data was discarded if the consistency index was >0·15. Then, the AHP data was determined and averaged for each

Table 2. *Analytic hierarchy process weight by stakeholder (indigenous/exotic zoonoses)*

	Incidence	Human-to-human spread	Case fatality	Diagnostic	Treatment	Prevention	Frequency of entry into Japan
Researchers ($n = 16$)	0·188/0·07	0·089/0·101	0·340/0·305	0·071/0·075	0·153/0·154	0·130/0·154	0·028/0·14
Physicians ($n = 21$)	0·074/0·066	0·102/0·09	0·130/0·115	0·321/0·285	0·169/0·15	0·176/0·156	0·028/0·14
Public health officials ($n = 257$)	0·119/0·105	0·159/0·141	0·250/0·221	0·118/0·104	0·162/0·143	0·165/0·146	0·028/0·14
Citizens ($n = 40$)	0·092/0·081	0·131/0·116	0·112/0·099	0·198/0·175	0·202/0·178	0·238/0·210	0·028/0·14

group. We calculated weights for each of the seven criteria by multiplying the respective risk-profiling value described in Table 1 by the average AHP weight determined by each stakeholder group and separated them into weights for diseases whether they were indigenous to Japan (Table 2). For example, with transmissible spongiform encephalopathy (TSE), a point in parameter 'incidence' can be calculated by multiplying the risk-profiling point for incidence (fewer than 30 people = 0·10123, see Table 1) by the stakeholder's AHP weight for this disease. Finally, all points derived from the seven criteria were added up to estimate total points for each disease in order to determine an overall ranking (Table 3).

RESULTS

Surveys were administered in paper form by the authors at the venues described below. Explanations were provided in Japanese to ensure understanding.

Researchers. These individuals were selected because of their varied specialities. Sixteen veterinary researchers in various fields (including the authors, all on a government grant project, except G.H.) evaluated the seven criteria, including one criterion that the other three groups did not evaluate (frequency of entry into Japan) for reasons described earlier. They conducted the AHP survey in 2010 after it was sent to them by the authors.

Physicians. Survey data from 21 physicians were obtained at an annual meeting in winter, 2011 in Obihiro, Japan as the easiest way of collecting data from such a group. These were not researchers but had family medical practices (i.e. they were not specialists) in small clinics in Obihiro. All of them completed the surveys properly and in full.

Public health officials. In November 2011, 257 government officers and officials were surveyed at an annual training course in Tokyo for individuals specializing in public health. People came from many regions of Japan, so the survey was thought to encompass a fairly representative sampling of the country. A total of 244 individuals completed the survey. They comprised medical doctors ($n = 7$), veterinarians ($n = 170$), nurses ($n = 17$), and medical technicians ($n = 33$). After removing incorrectly completed surveys, the final number of acceptable responses was 184.

Citizens. In October 2011, a public seminar on zoonoses risk communication was held at Kitazato University, a veterinary school in Aomori, Japan. Author Y.Y. presided with an attendance of 40 people. Thirty-two individuals took part in the survey, and 17 responses were deemed correctly completed; survey responses before the seminar were used. Although the number is small, the attendees had a strong interest in learning about information related to zoonoses.

Table 2 shows the weights of AHP scores for each of the four stakeholder groups: researchers, physicians, public health officials, and citizens. The column on the left indicates how many participants were in each group. Each AHP score represents values for indigenous (upper number) and exotic (lower number) zoonoses. The term 'indigenous' refers to diseases native to Japan, and 'exotic' refers to those that could be introduced into the country from outside. The values in the column on the far right (frequency

Table 3. *Analytic hierarchy process ranking/weight of the 20 most important zoonoses by stakeholder*

Infectious disease	Researchers	Physicians	Public health officials	Citizens
Transmissible spongiform encephalopathy	1/0·748	1/0·840	1/0·748	1/0·798
Severe acute respiratory syndrome	2/0·744	2/0·609	2/0·712	2/0·677
Ebola haemorrhagic fever	3/0·728	4/0·593	3/0·695	3/0·661
Marburg hemorrhagic fever	3/0·728	4/0·593	3/0·695	3/0·661
Lassa fever	3/0·728	4/0·593	3/0·695	3/0·661
Tick-borne encephalitis	6/0·694	3/0·593	6/0·657	6/0·646
Hantavirus pulmonary syndrome	7/0·675	9/0·526	10/0·582	12/0·571
Crimean-Congo haemorrhagic fever	8/0·672	10/0·526	7/0·591	9/0·575
South American haemorrhagic fever	8/0·672	10/0·526	7/0·591	9/0·575
Nipah virus disease	8/0·672	10/0·526	7/0·591	9/0·575
Eastern equine encephalomyelitis	11/0·659	14/0·510	13/0·565	14/0·554
Capnocytophaga infection	12/0·638	16/0·500	12/0·579	19/0·535
B virus disease	13/0·609	15/0·500	11/0·580	18/0·537
Lyssa virus infection	14/0·596	20/0·460	17/0·533	
Avian influenza	15/0·595		18/0·523	
Echinococcosis	16/0·583		16 /0·533	
Hendra virus infection	17/0·573	13/0·517	19/0·521	13/0·570
Japanese encephalitis	18/0·562		20/0·486	
Hepatitis E	19/0·538	7/0·533	14/0·542	7/0·596
Haemorrhagic fever with renal syndrome	20/0·527	8/0·529	15/0·534	8/0·590
Lymphocytic choriomeningitis		19/0·479		15/0·547
West Nile fever		17/0·488		16/0·544
Dengue fever		17/0·488		16/0·544
Omsk haemorrhagic fever				20/0·506
Kyasanur forest disease				20/0·506
Western equine encephalitis				20/0·506
Venezuelan equine encephalitis				20/0·506
Rift Valley fever				20/0·506

of entry into Japan) are derived only from the researchers because other stakeholders did not have enough knowledge to make that decision; therefore, all values in that column are identical.

Researchers and public health officials assigned the heaviest weights to case fatality (0·34/0·305 and 0·25/0·221, respectively), while physicians (0·321/0·285) and citizens (0·238/0·210) placed more weight on diagnosis and prevention, respectively. While person-to-person transmission of disease might be considered prominent in the minds of any of these stakeholders, in general it was not considered significantly more important than other factors by each stakeholder.

From the data on individual diseases in the prioritization list of 98 zoonoses, we constructed a list of 28 zoonoses within which the top 20 most important ones in Japan were selected by each stakeholder (Table 3). In general, stakeholders chose the same six diseases ranked in the highest positions of perceived importance, and TSE and severe acute respiratory syndrome (SARS) were identified as the two most important diseases for all stakeholders. The rankings for third to sixth places are identical for three out of four stakeholders, showing some consistency in their prioritization beliefs. For other diseases, it is clear that stakeholders held quite different opinions on ranking the zoonoses.

DISCUSSION

This paper describes the final version of our prioritization method of zoonotic diseases in humans in Japan and the results obtained from four stakeholders who employed it. There is good data available for human cases, but epidemiological data on the animal side is poor, especially for wildlife, so we decided not to include animal data in our study. We used a combination of risk profiling and the AHP method. The latter was selected because it appeared to be suitable for complex information situations and because it allowed non-technical individuals to score items with minimal confusion.

Scoring of AHP weights was performed by four stakeholders so that a variety of viewpoints could contribute to the process. AHP is a non-parametric method which uses relative comparisons, so there is no way to assess variability of individuals within stakeholder groups. Even so, the weighting had to be modified slightly to account for non-technical participants and those with less technical knowledge than the researchers. This use of multiple disciplines has been supported in the literature ([6] and references therein).

As a basis for establishing a standard process, we examined procedures described by major worldwide organizations. The International Federation for Animal Health Europe (IFAH-Europe) reviewed prioritization methods as a part of the DISCONTOOLS Project [14]. The World Health Organization (WHO) has also reviewed various countries' protocols for prioritizing communicable diseases surveillance [15]. In addition, the European Technology Platform for Global Animal Health (ETPGAH) has created an Action Plan in response to further its August 2005 vision statement and subsequent Strategic Research Agenda published in May 2006 [16]. The Action Plan details what is necessary to develop 'new tools for the control of major diseases and zoonoses', as outlined in six themes.

In general, the prioritization process involves choosing several indicators (priority diseases and health events), and a group of experts (steering committee) is assigned to attribute scores to them based on a set of criteria. The weights of scores are then evaluated mathematically to determine an overall ranking (prioritization) of the diseases. However, very few papers (none in Asia to our knowledge, hence the importance of this study) have been published concerning prioritization of zoonotic diseases. To provide a foundation of knowledge in the prioritization of human infectious diseases, we have examined a number of research reports.

McKenzie *et al*. [17] used a rapid risk assessment based on import risk analysis developed by the Office Internationale des Epizooties (OIE); the CA method was chosen by Ng & Sargeant [11, 18]; and the Dutch government RIVM project calculated weights using the probabilistic inversion method [19]. The Organisation for Animal Health Phylum [20] published a three-part report on listing and categorization of important zoonoses.

The objective of McKenzie's investigation was to develop and evaluate methodology for prioritizing wildlife pathogens, but only three people selected scores, and the semi-quantitative approach was not evidence-based. In the study by Ng & Sargeant, 29 characteristics were identified by 54 people in six focus groups [6] which consisted of individuals from the general public (~50% of the total) as well as epidemiologists, physicians, veterinarians, microbiologists, public health personnel, and various government policy-makers. The CA method was applied to 63 zoonoses in Canada using 1500 people only from the general public [11]. When the data were compared to that from over 1800 human health or animal health professionals [21], the results were similar to ours; the top five diseases were ranked very similarly for all survey respondents. Havelaar *et al*. [19] used a multicriteria analysis (MCA) method which combined objective and subjective information, and seven criteria weights were determined by infection disease specialists, risk managers from the public health ministry, and medical and veterinary students, but unlike Ng & Sargeant, there were no non-technical people involved in that determination. The OIE-commissioned report [20] compiled and sorted important zoonoses from various countries. Its 'aim was to consider as many criteria as possible, in order to constitute a base from which the most determinant criteria would be selected for the prioritisation/categorisation process'. Part two of the project was to generate a methodological manual which provided details on global and local approaches to analysing diseases.

At the beginning of the research we used only risk profiling with seven criteria for scoring disease risk. However, comments we received from researchers who were not part of the project on prioritization results suggested that we should add another method for adjusting differences in risk concepts among various stakeholders. That is why we combined two methods. AHP is a sociological method to quantify the relative importance of key characteristics of zoonoses. AHP was useful for logically estimating weights of seven criteria. These weights might differ among different stakeholders due to their different scientific and medical knowledge and their roles in society [6, 12]. We used both AHP absolute and regular evaluation methods, because this is flexible enough to evaluate zoonotic diseases not only all together but also in categories such as indigenous and exotic. In addition, it is easy to include alternative plans and to modify priority strategies.

It was interesting to note that physicians and researchers had different aspects regarding zoonotic diseases, as evidenced by the difference in their top weighting of the seven criteria (Table 2). The non-specialized physicians in our study felt diagnosis was most important, while scientific researchers rated case fatalities highest. Physicians are much more interested in clinical diagnosis but not infectious diseases that are exotic (i.e. not present in Japan). Based on severity alone (case fatality being a major characteristic), researchers are keen to prevent any disease from entering Japan. On the other hand, physicians have low profiles in exotic zoonoses because they rarely encounter them in their practice.

It is not difficult to imagine why public health officials ranked case fatality high, considering their role in epidemiological studies. Those in the current study comprised medical doctors ($n = 7$), veterinarians ($n = 170$), nurses ($n = 17$), medical technicians ($n = 33$), and others. Their responses were similar along this line to those of veterinary epidemiologists and public health experts surveyed by Humblet *et al*. [12] and Ng & Sergeant [21].

Regarding the general public, general safety was foremost in their minds, as shown by their ranking of prevention as number one in importance, even over that of diagnostic testing and treatment (which themselves were ranked almost identically in second and third positions). Perhaps the other items (case fatality, incidence, human-to-human spread, frequency of entry into the country) represent 'loftier' statistical issues intended for mere record-keeping by the other participants and not as more pragmatic topics such as prevention, diagnostic testing, and treatment, which are closer to heart regarding their personal health and security.

The differences in ranking for many diseases in our study, and others, might also be due to poor risk communication. This has been deemed valuable in avoiding panic and the waste of government spending – both are the result of reports from government and media on bovine spongiform encephalopathy infections – especially in Japan [22]. Therefore, such findings of differences in ranking could be utilized by clinicians and government health agencies for improving education, extension messages, and risk communication.

Concerning information flow on zoonotic diseases to stakeholders, each stakeholder is open to different sources and quantities. Researchers and health officials have easier access and are likely to have much updated information, while physicians might receive less information because they mainly read clinically orientated publications. In the future, we need to confirm such sources of information in detail. Moreover, media such as newspapers and telecommunications are apt to exaggerate unfamiliar names of diseases as well as symptoms but do not explain or stress important common diseases. Citizens are likely to be influenced by such distorted media information [22, 23]. If media people conducted similar questionnaire surveys to ours, citizens might tend to select diseases that were frequently broadcast on TV or radio.

A more even distribution in gender would also be beneficial. In the group of citizens 28 were male, nine were female, and three declined to state their gender in the survey. Conversely, the public health officials ($n = 257$) were almost equally divided by gender.

How participants are chosen might also affect results of any prioritization research. Unlike the much larger study by Ng & Sargeant [11] where they used 761 Canadians and 778 Americans solicited by electronic means, our group was recruited directly at a public seminar, and both methods have their weaknesses. For example, although email or web page surveys may have the advantage of reaching a larger population, it may be impossible to judge precisely who responded from such methods. That is, did the scoring come from just one person, or did people collaborate with friends and family members? For direct contact such as ours, group size may be a problem, but if any questions arose in how to interpret the questionnaires, there would be the opportunity to ask for clarification from the people conducting the survey.

Having identified a risk score, options for risk management such as surveillance and methods to reduce transmission risk can subsequently be considered for priority diseases, as we have done, rather than assessing them for the complete list of pathogens. Research priorities can be identified from the gaps in understanding of epidemiology and/or diagnostic tools to manage priority diseases.

The results of this study show that risk profiling coupled with the AHP method serves to identify the most important zoonotic diseases to address in Japan. We found differences among the stakeholders concerning various aspects of the zoonoses, and these can be explained by the background or societal role of each stakeholder. We suggest that communication between stakeholders should be based on those differences to provide the most efficient and accurate spread of information to the relevant people.

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DECLARATION OF INTEREST

None.

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