THE USE OF COST–BENEFIT ANALYSIS IN ANIMAL DISEASE CONTROL,

INCLUDING PRACTICAL EXAMPLES FROM THE REGION

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Original: English

Keywords: animal disease control – Asia – cost–benefit analysis

An on-line survey was conducted among OIE Member Countries to identify the animal diseases they consider important, their appreciation of and the extent to which they apply economic analysis as an aid to disease control in their country. The Delegates, or their representatives, of the 36 Member Countries of the OIE Regional Commission for Asia, the Far East and Oceania were asked to complete an on-line questionnaire, which consisted of 15 questions.

A total of 27 (75%) of the 36 countries completed the questionnaire (see Appendix).

Six diseases[2] were reported by at least 25% of the countries to be among the 'top five' diseases or pathogens of the reporting countries:

1. Foot and mouth disease (FMD)
2. Highly pathogenic avian influenza (HPAI)
3. Rabies
4. Newcastle disease
5. Classical swine fever
6. Brucellosis.

Thirty diseases and pathogens were identified as being in the 'top five' animal diseases of importance to the country (Table 1).

Nineteen diseases and pathogens were cited by at least two countries as being in the 'top five' most important diseases to the country:

1. FMD (78% of the countries)
2. Rabies (67%)
3. HPAI (67%)
4. Newcastle disease (37%)
5. Brucellosis (33%)
6. Classical swine fever (33%)
7. Porcine reproductive and respiratory syndrome (PRRS) (19%)
8. Transmissible spongiform encephalopathies (TSEs) (15%)
9. Infectious bursal disease (IBD) (7%)
10. Sheep and goat pox (11%)
11. African swine fever (7%)
12. Tuberculosis (7%)
13. Bluetongue (7%)
14. Peste des petits ruminants (PPR) (15%)
15. Haemorrhagic septicaemia (7%)
16. Anthrax (15%)
17. Leptospirosis (7%)
18. *Salmonella* Enteritidis (7%)
19. Equine influenza (7%).

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2 The name of the diseases are reported as per the respondent provided them

Table 1.– Diseases and pathogens considered among the five most important diseases and pathogens to countries in the Asia, Far East and Oceania region of the OIE

Disease or pathogen	No. of countries that responded	Mean rank of the disease*	No. of countries with a surveillance programme*	Wildlife is considered important*	No. of countries where disease is endemic*
1. American foulbrood	1	5.0	0	0	0
2. Anthrax	4	3.0	2	0	2
3. African swine fever	2	3.0	1	1	0
4. BGC	1	3.0	0	0	0
5. Bluetongue	2	3.0	2	1	0
6. Bovine babesiosis	1	1.0	1	0	0
7. Brucellosis	9	3.0	8	4	7
8. Classical swine fever	9	3.6	7	2	4
9. Equine influenza	2	5.0	2	0	0
10. Enterotoxaemia	1	5.0	1	0	1
11. Foot and mouth disease	21	1.8	16	6	10
12. Gid	1	5.0	0	0	0
13. HPAI	18	1.6	16	18	4
14. Haemorrhagic septicaemia	2	2.5	1	0	2
15. IBD	2	4.5	1	0	2
16. Johne's disease	1	5.0	1	0	1
17. Koi herpesvirus disease	1	4.0	1	0	0
18. Leptospirosis	2	3.5	0	0	2
19. LPAI	1	3.0	1	1	0
20. Newcastle disease	10	3.3	8	3	5
21. Nipah virus	1	4.0	1	1	0
22. PPR	4	3.0	1	0	2
23. PRRS	5	3.6	5	1	4
24. Rabies	15	3.6	10	9	7
25. *Salmonella* Enteritidis	2	3.0	2	1	1
26. Sheep and goat pox	3	4.0	1	0	0
27. Theileriosis	1	5.0	0	0	0
28. Tuberculosis	2	3.0	3	3	3
29. TSEs	4	3.8	4	0	0
30. White spot disease	1	5.0	1	1	0

*If reported in the 'top five' most important animal diseases and pathogens by a country

BGC = bovine genital campylobacteriosis; HPAI = highly pathogenic avian influenza; IBD = infectious bursal disease; LPAI = low pathogenic avian influenza; PPR = peste des petits ruminants; PRRS = porcine reproductive and respiratory syndrome; TSEs = transmissible spongiform encephalopathies

Eleven other diseases and pathogens were selected by 10 countries to be in the 'top five':

1. American foulbrood (AFB)
2. Bovine babesiosis
3. Bovine genital campylobacteriosis (BGC)
4. Enterotoxaemia
5. Johne's disease
6. Koi herpesvirus disease
7. Gid
8. Low pathogenic avian influenza (LPAI)
9. Nipah virus
10. Theileriosis
11. White spot disease.

Surveillance programmes

Twenty six (96%) of the countries that responded to the questionnaire reported having at least one surveillance programme for their 'top five' diseases and pathogens.

Countries reported that they had a mean of 3.6 (± 1.6) surveillance programmes in their country for their 'top five' diseases or pathogens. The number of countries with a surveillance programme was highest (23/27) for a country's most important disease, and decreased to 21, 19, 18 and 16, as the importance of the disease decreased to 2nd, 3rd, 4th and 5th ranking position, respectively. Countries reported surveillance programmes for 25 of the 30 reported diseases and pathogens. The only diseases without a surveillance programme were American foulbrood, bovine congenital campylobacteriosis, gid, leptospirosis, and theileriosis.

Wildlife diseases

Wildlife was considered important in the epidemiology or in the transmission of diseases in 24 (89%) of the 27 countries, with respect to at least one of their five most important animal diseases and pathogens. Furthermore, wildlife was not considered important for one half (15/30) of the diseases identified as important by countries.

Among the diseases and pathogens considered important by at least two countries, there were only three diseases and pathogens for which wildlife was considered important by more than 50% of the responding countries:

1. HPAI (17/18)
2. Rabies (9/15)
3. Tuberculosis (3/3).

For the six most frequently ranked diseases and pathogens, namely FMD, HPAI, rabies, Newcastle disease, classical swine fever and brucellosis, the number of countries believing wildlife to be important ranged greatly: 6/21, 17/18, 9/15, 2/9, and 4/9, respectively.

37% to 56% of the five most important diseases and pathogens cited by these countries were considered to be endemic. The 1st, 2nd and 5th most important diseases and pathogens were each reported to be endemic by 10 countries (37%), whereas 15 countries (56%) and 13 countries (48%) indicated that the 3rd and 4th most important diseases, respectively, were endemic.

Economic analysis

A total of 31 economic analyses were reportedly used by 13 (48%) of the 27 responding countries.

The most frequently economically-analysed disease was FMD (12 countries), followed by HPAI (6 countries), and to a lesser extent, Newcastle disease, PRRS and brucellosis (each by 2 countries), and equine influenza, bovine babesiosis, Johne's disease, rabies, tuberculosis and TSEs (each by 1 country).

Of the 13 countries that reported using an economic analysis on a disease, 12 reported they had performed one on their most important disease or pathogen, decreasing to 8 for the 2nd most important disease or pathogen, and 4 each for the 3rd, 4th, and 5th most important diseases or pathogens. Of those 13 countries, 2 had performed a recent analysis on all five diseases or pathogens, 4 on three diseases or pathogens, 2 on two diseases or pathogens, and 3 on a single disease or pathogen.

A total of 25 economic analyses were performed for the 'top five' diseases or pathogens in 11 of the 18 responding countries. Seven countries indicated that they had not performed an economic analysis on any of the 'top five' diseases or pathogens. Among these analyses, 10 were conducted on the 1st ranked disease or pathogen, and 7, 4, 4, and 4 were conducted on the 2nd, 3rd, 4th, and 5th ranked diseases or pathogens, respectively.

Of the countries that indicated the most recent year in which each of the five most important diseases or pathogens had been the subject of an economic analysis, four reported having performed such an analysis as recently as 2012 or 2013. The oldest of these analyses was performed by a country in 2005.

The type of economic analysis included social cost–benefit analysis, partial budgeting, economic losses (impact) of the disease, input/output (I/O) analysis, welfare analysis, general equilibrium analysis, eradication cost estimate, macroeconomics, sectoral analysis, scenario modelling and economic impact study, cost-effectiveness analysis, trade policies on economic impacts, socio-economic impact analysis, partial budgeting and welfare analysis, I/O and general equilibrium analysis, and cost impact Computable General Equilibrium (CGE) model at both the macro and sectoral levels.

Availability of data

An obstacle to performing an economic analysis on an animal disease is lack of data. Several questions were asked concerning availability of the data necessary for an economic analysis and whether the country had the information, did not have it but would collect it, or did not have it and would not collect it. The results to these questions appear in Table 2.

Table 2.– Responses from 27 countries in the Asia, Far East and Oceania region of the OIE regarding the availability of data needed to conduct an economic analysis of an animal disease

	No. of countries that		
	have the data	do not have the data but will collect it	do not have the data and will not collect it
No. of animals	24	2	1
No. of production units	18	7	2
Average production per animal	19	6	2
Production impact of disease	23	3	1
Efficacy of controls	8	17	2
Disease prevalence	18	8	1
Disease incidence	17	9	1
Trade impact of disease	4	22	1
Subsistence farming impact of disease	5	15	7
Animal movement	11	14	2
Indirect contacts*	4	15	7

* 1 country did not respond to this question

As seen in the table, the majority of countries had data regarding the number of animals (24/27 countries), number of production units (18 countries), average production per animal (19 countries), production impact of disease (23 countries), disease prevalence (18 countries), and disease incidence (17 countries). On the other hand, few countries had information on the trade impact of disease (4 countries), subsistence farming impact of disease (5 countries) and indirect contacts (4 countries). Of the countries that did not have the data, the vast majority were willing to collect it, with the exception (7 countries each) of data on subsistence farming and indirect contacts.

Follow-up of economic recommendations

Regarding whether or not the economically-based recommendation was followed if a cost–benefit analysis was performed, 10 countries replied 'yes'. As a follow up to this question, 2 of the 10 countries that reported that the economic recommendation was followed, all but two reported that the implementation of the recommended control was successful.

Participants were asked to comment on how useful they felt cost–benefit analysis was in disease control in their country. The majority (16/27) responded that it was very important, 10 felt it was somewhat important and a single respondent believed it was not important.

When asked how frequently cost–benefit analysis was used in disease control in their country, nearly one half (13/27) of the respondents stated 'not frequently', while 9 said 'somewhat frequently', and only 5 reported 'very frequently'.

Member Country Delegates/representatives were asked to report on the most recent cost–benefit analysis for an animal disease conducted in their country. Of the 6 responding to this question, 2 reported that a study was conducted in 2013, 2 in 2012, and 1 each in 2011 and 2008.

For those studies, respondents were asked specific outcomes such as the benefit–cost ratio, present value of benefits, present value of costs, net present value, internal rate of return, and time horizon and discount rates used. Two countries provided benefit–cost ratios, which were very high, 18 and 75. One country responded with a net present value, which was approximately USD 50 billion. None presented a present value of costs figure but one country reported a net present value, which was negative at approximately USD 120 million. Three countries reported time horizons used in their analysis, which ranged from 10 (2 countries) to 30 years. Two countries reported the discount rates used, and these were very similar, 7% and 8%.

Information sharing

An important part of conducting an economic analysis of a disease control programme concerns the dissemination of the results. When asked about the dissemination of the results of any cost–benefit analysis of animal disease control conducted in the past five years, five countries reported they had made the results available in an official report, while four reported they had made it available as a scientific presentation.

As a follow-up to this question, participants were asked if the results of their analyses were available to the public, in their country, or to other OIE Member Countries. Regarding whether or not they were

available to the public in their own country, responses included 'always' (2 countries), 'usually' (2 countries), 'occasionally' (3 countries), 'never' (2 countries), and 'not applicable' (10 countries), meaning no reports were written. Results were even less accessible to OIE Member Countries: 1 country responded that its reports were always available, none that they were usually available, 9 that they were occasionally available, 5 that they were never available, and the other 12 countries stated that the question was not applicable.

Contrary to the above responses, which showed that few countries made their findings available to other OIE Member Countries, nearly all (26/27) of the respondents to this question said they would find it helpful to have access to unpublished reports on the socio-economic animal disease impact from other countries.

Following along the line of sharing information, respondents were then asked if the country had ever participated in a multi-national animal disease economic analysis. Possible responses were as follows: 'yes, frequently'; 'yes, occasionally'; 'no, but it would be useful', or; 'no, and not interested'. Twenty four (89%) of the respondents replied 'yes, occasionally', another stated 'yes, frequently' and the other said 'no, but would be interested in doing so'.

Animal disease control

Concerning the importance of an economic analysis to aid the control of animal disease, Member Countries were asked to comment on the extent to which they believed that animal disease control decisions made in their country should be based on socio-economic criteria. Nearly 90% said either 'absolutely' (12/27) or 'mainly' (12), and the remaining three replied 'to some extent'. None of the respondents felt that these decisions should not be based on socio-economic criteria.

Following the line of questions regarding the perceived importance of economics informing animal disease control decision making, respondents were asked to comment on whether or not they believed more socio-economic analyses of the impact of animal disease should be made in their country. Nearly all (25/27) replied 'yes'. One of the two countries that replied 'no' has an active history of applying economic analysis on animal diseases, while the other country reportedly had not performed such an analysis in the past five years.

Role of the OIE

The final question asked how the OIE could encourage more extensive and effective use of socio-economic analysis of animal disease impact. Respondents were asked to select from among five approaches and offer an additional topic if they so wished. The approaches consisted of the following: delivering regional workshops; producing guidelines for socio-economic analysis of animal disease impact; maintaining an index register of analyses undertaken by OIE Member Countries; and providing a list of relevant experts. Their responses appear in Table 3.

Table 3.– Responses from 27 countries in the Asia, Far East and Oceania region of the OIE regarding how the OIE can encourage more extensive and effective use of socio-economic analysis of animal disease impact

Approach	No. of respondents
Deliver regional workshops	25
Produce socio-economic guidelines	26
Maintain register of analyses	17
Provide list of experts*	20
Other	6

* 1 country did not respond

Almost all the respondents believed delivering regional workshops (25/27 countries) and producing guidelines for socio-economic analysis of animal disease impact (25 countries) were good ideas. The majority also felt that maintaining an indexed register of analyses undertaken by Member Countries (17 countries) and providing a list of relevant experts (20 countries) were good ideas. Additional recommendations included the following:

- an *ad hoc* group for socio-economic analysis of animal disease impact to be convened by the Director General of the OIE;
- encouraging working groups from countries to work together;
- providing financial assistance to Member Countries conducting socio-economic analyses;
- conducting training on socio-economic analyses principles;

- conducting on-line training related to socio-economic analyses of animal disease impact; and
- the need for technology, capacity building, budget.

Conclusion

Strong support was shown by the responding OIE Member Countries regarding the importance of applying economics to assist in animal disease control decision making. The extent to which economics is used to inform decision making in animal health varies greatly among Member Countries in the region. Suggestions as to how countries can improve their capability to conduct these analyses include delivering regional workshops, producing guidelines for socio-economic analysis of animal disease impact, maintaining an indexed register of analyses undertaken by Member Countries and providing Member Countries with a list of relevant experts.

.../Appendix

Appendix

Responding countries

A total of 27 (75%) of the 36 OIE Members in the region completed the questionnaire:

1. Australia
2. Bhutan
3. Brunei
4. China (People's Rep. of)
5. Chinese Taipei
6. Fiji
7. India
8. Iran
9. Iraq
10. Japan
11. Korea (Rep. of)
12. Malaysia
13. Maldives
14. Mongolia
15. Myanmar
16. New Caledonia
17. New Zealand
18. Pakistan
19. Papua New Guinea
20. Philippines
21. Russia
22. Singapore
23. Sri Lanka
24. Thailand
25. Timor-Leste
26. Vanuatu
27. Vietnam.

Definitions

B/C ratio	Total discounted benefits divided by total discounted costs.
Discount rate	This is 1/(1 + real interest rate). It is used to compare future costs and benefits with those occurring today.
Economic analysis	The systematic approach to determining an efficient allocation of scare resources, It typically quantifies costs and revenues of an action but also may consider distribution and employment impacts.
Internal rate of return (IRR)	The discount rate needed in order to make the B/C ratio equal to 1 and the NPV equal to 0.
Net present value (NPV)	Total discounted benefits minus total discounted costs.
Nominal interest rate	The rate of interest before adjusting for inflation.
Real interest rate	The nominal interest rate minus inflation.
Time horizon	The number of years the project's benefits and costs are being calculated for an economic analysis.
Total discounted benefits	The sum of benefits, discounted over the project's time horizon.
Total discounted costs	The sum of costs, discounted over the project's time horizon.