Use of Multi-Criteria Decision Analysis to assess impacts of rabies, brucellosis and their interventions

Section I. The idea

Problem statement

The importance of developing inter-sectoral collaborations among the animal, environment and human health sectors in ensuring health protection and food security is now well recognized.(*1*) A major barrier preventing these collaborations is the difference in goals for the three sectors.(*2*) While the animal health sector aims to increase productivity and food safety; the environment sector works on conservation and hygiene related issues; and the human health sector on achieving health protection.

In the context of zoonoses, where the disease might originate in one sector and affect another, the difference in perspectives gets further accentuated and prevents officials from one sector to commit resources for what is perceived to be 'someone else's' problem.

Proposal

Though there is a strong case for the use of economic evaluation methods to allow a holistic and comparative assessment of impacts of zoonoses across sectors(*3*, *4*), currently we do not have any methodological approach that allows a simultaneous evaluation from the perspective of more than one sector. Indeed, several economic evaluations in the past have incorporated data from multiple sectors but ended up evaluating benefits from the perspective of one sector only.(*5*, *6*)

The creation of a new 'one health' metric is a challenging goal. An innovative way to produce a comparative assessment of the impact of zoonotic diseases across sectors could be to use existing sector-specific metrics but have an overarching evaluative framework. We propose to **develop an integrative framework for economic evaluation that enables simultaneous sector-specific assessment of impact of zoonoses and their interventions, across sectors and pathogens using a single integrated database. Instead of a common metric, this adapted Multi Criteria Decision Analysis Approach allows for sector specific metrics to be used to measure the impact across sectors.**

Multi Criteria Decision Analysis is a widely used analytical method in the disciplines of operations research(*7*), natural sciences(*8*) as well as in considering stakeholder concerns in health evaluations(*9*). It is typically used to inform decision in the context of *multiple streams of dissimilar information*(*10*) where more than one criteria is needed to make a decision. It offers different ways to aggregate information from multiple sources, like quantitative scoring of different values to get a total impact score or qualitative performance matrix. We propose to adapt it for One Health.

For example, in the hypothetical example below, each sector has its own way of measuring the cost of intervention. These could be compared qualitatively using a performance matrix. Alternatively, the figures could be weighted using weights reflecting the judgment of major stakeholders, a total impact score could be calculated that could allow interventions to be compared across sectors and among each other.

Different Intervention scenarios	Animal Sector (No. of cattle heads saved per $100,000 spent)	Environment Sector (No. of outbreaks prevented in peri-forest areas per $100,000 spent)	Human Sector (Human lives saved per $100,000 spent)	Total impact score
Intervention A	31	2	12	9.4
Intervention B	23	3	9	7.8
Weights	15	55	30	

The feasibility of this evaluation framework will then be tested for two diseases, namely, rabies and brucellosis in a common geographical setting. While rabies is a major priority from the human health sector, brucellosis enjoys greater attention of the animal health sector. Developing an evaluation framework around both the diseases will allow us to identify challenges in assigning weights for sectors in a variety of settings.

Section II. Proposed work plan

Analytical plan

Decision analytic and extrapolation modelling approaches will be used to develop an integrative evaluation model factoring the burden of zonooses and the impact of different interventions on all affected species and sectors. An integrative database will be prepared containing input factors from multiple sectors. Costs, cost-benefit or cost effectiveness of different intervention scenarios will be calculated in parallel for all the three sectors and expressed in the sector-specific metric. These will then be weighted using weights derived from stated preferences of different stakeholders and scored to arrive at a total impact score. In addition, a qualitative performance ranking could be done as a validation check.

Activities

It is proposed to divide the project in three phases of six months each. The first phase would include a multisectoral consultation of decision makers to ensure the concerns and values of principle stakeholders are taken into account and inform the development of relative weights. Secondary datasets relating to the disease epidemiology, efficacy and costs of interventions will be mobilized and integrated.

The second phase will include development of the evaluation framework which will be validated through an international workshop of technical experts in the area. The evaluation framework will be pilot tested in a specific setting using a combination of field based, secondary and extrapolated data. The third phase will see the finalization of the evaluation framework and initial results and a second stakeholder consultation will be organized to assess the usefulness of the developed protocol.

The proposed project will have the following cost centres: Investigator time; expert consultations; travel; IT and open access publications costs.

Expected outputs & Next steps

The proposed project is expected to result in the development of a novel methodological framework that will allow costs and benefits of zoonoses and their interventions to be simultaneously evaluated from the perspectives of different stakeholders. This will be done using an integrated dataset, the architecture of which will also be developed for the first time. Moreover, the proposed project will enable the application of Multi Criteria Decision Analysis in zoonoses for the first time.

Once the practical feasibility of the novel techniques proposed in the project are is demonstrated, these will be documented in the form of peer reviewed publications. In the next phase, these approaches could be standardized by applying these in diverse ecological and political settings and developed into a standard protocol or set of guidelines.

References

1. Congress Organising and Scientific Advisory Committee, 1st International One Health Congress Summary, 1–11 (2011).
2. R. J. Coker *et al.*, *The Lancet infectious diseases* **11** (2011), doi:10.1016/S1473-3099(10)70312-1.
3. J. Rushton, B. Häsler, N. De Haan, R. Rushton, *Onderstepoort Journal of Veterinary Research* **79**, 1–5 (2012).
4. The World Bank, *People, Pathogens and Our Planet: Volume 2: The Economics of One Health* (Washington DC, 2012), pp. 1–65.
5. D. L. Knobel *et al.*, *Bulletin of the World Health Organization* **83**, 360–8 (2005).
6. F. Roth *et al.*, *Bulletin of the World Health Organization* **81**, 867–76 (2003).
7. J. Figueira, S. Greco, M. Ehrgott, *International Series in Operations Research & Management Science* **78**, 1048 (2005).
8. G. a. Mendoza, H. Martins, *Forest Ecology and Management* **230**, 1–22 (2006).
9. S. Youngkong, Y. Teerawattananon, S. Tantivess, R. Baltussen, *Health research policy and systems / BioMed Central* **10**, 6 (2012).
10. R. Baltussen, L. Niessen, *Cost effectiveness and resource allocation : C/E* **4**, 14 (2006).