Bovine Spongiform Encephalopathy (BSE) Risk Assessment Models: A comparison and their application in various country data.

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Summary
Two major Bovine Spongiform Encephalopathy (BSE) risk assessment models, the Harvard Model (HM) (1) and the Geographical BSE-Risk (GBR) (2,3), were compared using data from three sources (Uruguay, Denmark, and the North American System composed of the USA and Canada) presenting a different risk regarding their likelihood to have imported, amplified and spread the BSE agent. The Harvard Model was found to address exclusively the consequences in a country of the import of BSE infectivity, while the GBR only considered the likelihood of having the BSE agent within the borders, at a certain point of time, in a qualitative way.

Introduction
The risk assessments for Bovine Spongiform Encephalopathy (BSE) have come to the forefront of attention for public safety and animal health in many countries mainly due to the increased concern regarding the spread of BSE. Unfortunately, there is significant increasing resistance to accept the conclusions of a particular model within the scientific community and from many countries regarding BSE risk assessment due to the assumptions that may not apply to a specific situation. The ongoing disagreement between BSE risk assessment models clearly speaks to the need for comparison of methods and assumptions used in any of those models, to be able to acknowledge any of their results.

Objectives
This study was conducted to a review of the comparison between the Harvard Model (HM), developed by and applied on the USA, and the GBR, developed by the European Union- Scientific Steering Committee (SSC). Our intention was to compare both the HM and the GBR in terms of their coverage, parameters used, and applications.

Materials and Methods
The comparison of the two risk assessment models (GBR and HM) was made by evaluating the parameters needed for the risk assessment Specific parameters that were considered included the ID50s[1], efficacy of the rendering systems, measures taken to prevent cross-contamination, MBM[2] bans, other policies taken regarding BSE, structure and dynamics of the bovine population, surveillance of BSE, BSE related culling, import of cattle and MBM from BSE infected countries, and animal feeding practices. The evaluation of the outputs was compared after applying

[1] The amount of infected material which, when given in clinical tests to each member of a bovine population, infects 50% of the members within the population.
[2] Meat and Bone Meal

identical data sets to each of the models. The evaluation of the likely number of infected cattle from BSE infected countries was obtained by computer simulation using the risk analysis software @ RISK (4). Conclusions were achieved after processing data from the countries to be assessed through each model and checking for discrepancies or similarities in the output parameters.

Results

The stability of the Uruguayan system is presented in a different manner by the two models, but they nevertheless reach the same conclusion. The HM shows that the Uruguay cattle system, even with the import of just one infected animal, would be unable to control the spread of the infectivity, at least until the implementation of a Mammalian to Ruminant feed ban. The GBR states that the BSE agent, had it entered the Uruguayan cattle population, would have been amplified and spread, therefore causing a major outbreak. Whereas the GBR deals with the probability of the adverse event occurring in Uruguay strictly qualitatively, the Harvard model outlines the main factors affecting stability in the country.

In the Danish example, too, the stability of the system is presented in a different manner by both systems. While the Harvard Model can include and evaluate the importance of labeling as early as 1990, this information is totally disregarded in the GBR approach, the feed ban appearing as the main improvement in the Danish cattle system. The conclusions arrived at by both models are therefore totally different on that matter. The Harvard Model shows that as early as 1990, the Danish cattle system starts reducing the BSE-infectivity, while stability is only reached after 2000 in the GBR, when the system become stable in 1997 (the reduction of infectivity being slow) and improving after 2000 when it becomes optimally stable allowing for a very fast reduction of BSE-infectivity.

The baseline scenario used to reach the conclusion in the Harvard Report (1) on the stability of the US cattle system assumed that the implementation of the feed ban in 1997 had occurred prior to initiation of the simulation. An alternative model was created for this comparative study and applied to the US, assuming initiation of the simulation prior to the 1997 feed ban. The results found in this alternative scenario are close to one of the alternative scenarios run and presented in the Harvard Model report (1) when considering the simulated risks after importing infectivity from the UK during the outbreak and reflecting the actual situation of the US at the time (lack of feed ban until 1997, changes in the stunning process and the splitter methods).

The overall conclusion on the stability of the US cattle system is the same based on results from both models: if the BSE agent had entered the US cattle population, it would have been amplified and spread, therefore causing a major health problem for the US cattle industry.

Discussion

This study showed that conclusions about BSE risk from the GBR and the Harvard Model should not be compared on the same basis, since they represent different and independent assessment of risk.. The Harvard Model and the GBR do not substitute for each other, as it has been thought so far, but are complementary in their method of

assessing BSE risk. Therefore a bridge could be built between both risk assessment models in order to implement one risk assessment model that would consider at the same time probability and consequences when assessing any risk regarding BSE. Indeed, a model that would present both characteristics could more accurately portray BSE risk for a given country. In addition some recommendations can be inferred from this study about risk assessment models.

Any risk assessment model should present a distribution of the risk, giving a range of probability estimate of the adverse event to occur. It should allow the user a certain fluidity to assess plainly the risk considered. Useful models should avoid being too structured and simplified to give a precise idea of the probability of the BSE risk. Variations in levels of available information between countries must be reflected in the uncertainty about model results. Conversely, any model of pragmatic use must be readily modifiable with a reasonable analytical investment. A such-designed model would escape the major problem of being too complicated to be used on a daily basis. Neither the GBR nor the HM fully meets these aspirations.

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