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Current approaches in BSE risk assessment - added value and limitations

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Passive and Active Surveillance

Many studies are published dealing with existing data on reported BSE cases to assess the local BSE epidemic (UK: Wilesmith, Donnely and Ferguson), and the results of active BSE surveillance (Switzerland Doherr et al). These methods are very good for quantifying the prevalence and development of BSE in countries with an established BSE epidemic. Determining the BSE prevalence in countries with "low" BSE risk is not as easy, and requires more extended risk assessment.

First steps to Risk Assessment

Table 1 (copied from Schreuder et al. *Vet.Rec.* 1997)

Numbers of potential BSE cases imported into EU countries 1985 - 1989			
		Number if imports were:	
Country	Average	Beef only	Dairy only
Greece	0	0	0
Belgium + Lux	17	2	24
Denmark	29	3	40
France	32	4	43
Netherlands	44	5	62
Italy	50	6	68
Spain	54	6	74
Germany	243	30	334
Portugal	262	26	370
Ireland	911	103	1263

Schreuder et al combined the existing UK prevalence data with data on export of live cattle from the UK to the EU. Most EU countries should have detected tens to hundreds of BSE cases (See Table 1), given the number of cattle they imported from the UK. This actually led to diplomatic trouble at the time, since most countries were actively claiming freedom from BSE.
It was not clear whether the infection could spread within these countries. Therefore, studies on the efficacy of control measures for BSE followed, focussing on rendering, feeding and SRM removal. Results are summarized in a quantitative method by de Koeijer et al (2004) in the form of a calculation of the basic reproduction ratio for countries based on the local situation and control measures. (See Table 2)

Table 2 (copied from deKoeijer et al. *J.Math.Biol* 2004)

Estimated reproduction ratio for the UK and the Netherlands, depending on implemented control measures				
R_0 (95% CI upper limit)	1986	1991	1995	1998
UK	14 (25)	0.1 (0.3)	0.05 (0.1)	0.03 (0.1)
Netherlands	0.7 (1.3)	0.2 (0.5)	0.08 (0.1)	0.05 (0.1)

The EU initiated the Geographical BSE risk assessment in 1998, which developed into a semi-quantitative method that incorporates these two main steps in BSE risk assessment: Firstly, has a country imported potentially BSE infected animals or meat and bone meal (MBM), and secondly, would the infection spread within the local cattle population, i.e. is the reproduction ratio above or below 1. A simple stepwise method was applied to determine the BSE risk based on these two main steps. During the last 5 years, the EU GBR method has proven itself, by putting various countries in BSE risk class III, where BSE was detected soon afterwards. At present, this is the best validated method of BSE risk assessment world wide. (See Table 3 for an overview)
By now, the limits of the semi- quantitative method are reached, as many European countries have decreasing epidemics by now, so that assessment of the dynamics of the infection over time becomes more important than before. Furthermore, the level of BSE prevalence vary a lot over the risk countries (class III and IV), which is not taken into account.

Table 3 (from the EFSA website)

Country name	current GBR	remark
Andorra	III	
Albania	III	reassessment ongoing
Argentina	I	
Australia	I	reassessment ongoing
Austria	III	
Belarus	III	
Belgium	III	
Botswana	I	reassessment ongoing
Brazil	I	
Bulgaria	III	
Canada	II	reassessment ongoing
Chile	I	
Costa Rica	I	
Colombia	II	reassessment ongoing
Croatia	III	
Cyprus	III	
Czech Republic	III	
Denmark	III	
El Salvador	I	reassessment ongoing
Estonia	III	
Finland	III	
Former Yugoslav Republic of Macedonia	III	
France	III	
Germany	III	
Greece	III	
Hungary	III	
Iceland	I	
India	II	reassessment ongoing
Ireland	III	
Israel	III	
Italy	III	
Japan	III	
Latvia	III	
Lithuania	III	
Luxembourg	III	
Malta	III	
Mauritius	II	
Namibia	I	reassessment ongoing
Netherlands	III	
New Caledonia	I	
New Zealand	I	
Nicaragua	I	reassessment ongoing
Nigeria	II	
Norway	I	reassessment ongoing
Pakistan	II	reassessment ongoing
Panama	I	reassessment ongoing
Paraguay	I	
Poland	III	reassessment ongoing
Portugal	IV	
Romania	III	
San Marino	III	
Singapore	I	
Slovak Republic	III	reassessment ongoing
Slovenia	III	
Spain	III	
Swaziland	I	reassessment ongoing
Sweden	II	reassessment ongoing
Switzerland	III	reassessment ongoing
Turkey	III	
United Kingdom	IV	
Uruguay	I	
USA	II	reassessment ongoing
Vanuatu	I	

Quantitative methods

In the USA a very complete and extended model was built, intended to prove the freedom of the USA from BSE infections. This model includes import risk from the UK and the disease dynamics over time. However, it ignores the risk of imports from lower risk countries and is more optimistic/ generous than the EU GBR method in assessing the efficacy of feed bans and prevention of cross-contamination and the local surveillance. It concluded that the presence of BSE in the USA and Canada was highly unlikely. Recently, a few BSE cases have been detected in Canadian cattle, proving the method wrong.
Norway has applied a quantitative method (de Koeijer et al 2003) that follows the lines of the EU GBR method (Hogasen et al), and concluded that Norway has a low probability that BSE infected cattle are presently in the population.

Future plans

The approach of Hogasen et al. can be used for the assessment of low risk and low prevalence countries and should be extended for general use. It should also be able to handle available information on surveillance, and extrapolate to assess past and future prevalence, and the efficacy of control measures in the past.
Based on the results of such methods, we can than extrapolate to determine the human BSE risk over the last 25 years, and in the future, under various control scenario's. Thus we will assess the risk of vCJD disease cases and new infections in the future. This can be based an assessment of the UK vCJD epidemic together with the BSE epidemic is needed, such as given by Ghani et al.

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