APPENDIX 3

Risk Assessment for the Import of Meat and Meat Products Contaminated with Foot and Mouth Disease Virus into Great Britain and the Subsequent Exposure of GB Livestock[1]

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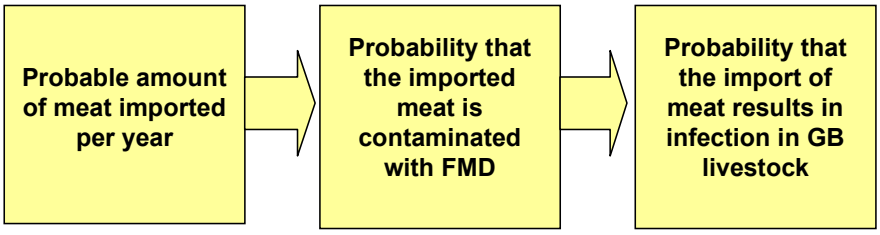
Background, model outline and general approach

This study aims to assess the disease risk posed to the livestock population of Great Britain (GB) from the illegal importation of meat and meat products and to estimate major contributors to this overall risk. The risk assessment considers importation of meat and meat products that are derived from susceptible animal species from all inhabited territories of the world, into GB. The assessment is conducted up to the point of infection of one susceptible animal; the spread of this initial case is not considered in this assessment. Given exposure, all strains of FMD are assumed to pose an equal risk of infection to GB livestock.

For this complex risk assessment, a model has been developed in a modular manner, consisting of three modules describing distinct stages in the processes that lead to the undesired outcome. The model framework is shown in Figure 1. To estimate the risks associated with importation of illegal meat, the modules are: 1) Estimating the flow of illegal meat into GB; 2) Estimating the probability that illegally imported meat is contaminated with FMD virus (FMDV); and 3) Development of exposure pathways and estimation of the probability and frequency with which contaminated, illegally imported meat results in an infection in GB livestock. Together, these modules represent the various transfer pathways of the virus from its country of origin to livestock in GB via the illegal importation of meat, and have been integrated to estimate the overall risk.



[1] Summary Prepared for 35TH General Session of the EU FMD. The full report is available at www.defra.gov.uk/animalh/illegali or from risk.assessment@defra.gsi.gov.uk

Figure 1: Model framework showing the three stages of the risk assessment

Main findings, results, and conclusions

This risk assessment estimates the frequency of infection in GB livestock of FMD as a result of the importation of meat. There are numerous model variables that are associated with a high degree of uncertainty. To reflect this uncertainty the risk model is stochastic in nature, therefore input variables are described by probability distributions that reflect the degree of uncertainty associated with that input. As a result, estimates of risk are also described by probability distributions. These distributions describe our uncertainty associated with the estimate of the frequency of infection in GB. Therefore, for each of the key results, the mean value from the associated probability distribution is reported, along with the 90% uncertainty interval. All results should be considered in the context of their associated uncertainty.

Entry of illegal imports of meat products to GB

From model results, the total amount of illegal meat entering GB each year is estimated to be 7,431 tonnes, with 90% certainty that this is between 2,771 and 17,484 tonnes per year. This is equivalent to approximately 3% of the total volume of legally imported meat per year from non-EU countries or 0.6% of the total meat imports, including that from other EU countries (based on 2001 year end figures). It is estimated that 85.2% of the total weight of illegal meat enters GB via personal baggage. 11.2% is smuggled in sea freight and the remainder via air freight (3.2%) and post and courier (0.3%). Of this total flow, it is estimated that 55% is actually intended for commercial use (distribution through wholesalers, street markets and other retailers). The five major contributing regions to the total flow are Eastern Europe, Eastern Asia, West Africa, Near & Middle East, and Southern Africa which together account for 83% of the total estimated flow of illegally imported meat.

By definition, there are no records of attempted illegal importation which are actually successful. Not surprisingly, no importers of illegal meat products volunteered information to the risk assessment team. Therefore, underpinning this estimate is the derivation of the scale factors that indicate the proportion of illegally imported meat consignments that are detected per year. Generic scaling factors were derived based upon data and expert opinion. In cases where there is evidence of targeting to detect meat or for other purposes, the scale factors were adjusted accordingly.

- These scale factors are the greatest contributors to the uncertainty in the estimate of the volume of illegal meat entering per year.

Level of contamination of illegal meat product imports

The amount of meat entering GB illegally each year which is contaminated with FMDV is estimated to be, on average, 95 kg with 90% certainty that the

amount is between 30 kg and 244 kg per year. This corresponds to, on average, 0.001% of the total flow of illegally imported meat.

This estimate is influenced by the estimate of prevalence of FMD in each region which is in turn based upon country level estimates of prevalence. Countries fall into two main categories; those considered internationally to be free from FMD, and those considered to have endemic FMD. For countries considered to have endemic FMD, module 2 estimates the probable prevalence of FMD in each country. For countries categorised as free, the model estimates both the probability of an incursion, and the probable prevalence before detection in free countries should they suffer an incursion. For both categories, historical outbreak occurrence data reported to the Office International des Epizooties (OIE) is used as the primary data source, supplemented with data from the United States Department of Agriculture (USDA), the European Commission for the Control of Foot and Mouth Disease (EUFMD), and FMD World Reference Laboratories, especially Pirbright, with the data adjusted for suspected under-reporting largely based on information from Pirbright. For a number of countries considered, there is no source of direct data on their FMD status and assumptions based on their regionality are made. This is a key area of data deficiency.

- The situation regarding under-reporting is another key area contributing to the model uncertainty.

Exposure and infection in GB

Estimates of risk are obtained through the integration of the estimation of the flow of illegal meat and levels of contamination, with a mathematical description of the routes by which livestock may be exposed to FMDV which enters the country as a contaminant of meat. These estimates are based upon consideration of the exposure routes by which livestock may be exposed to any FMDV which is contaminating imported meat and meat products. Throughout model development, extensive investigations were undertaken to ensure all possible risk pathways were considered. The pathways considered in the model are illustrated in Figure 2. The estimates give, with 90% certainty, the result that the current annual probability of infection in GB livestock is between 0.0009 and 0.02 with a mean value of 0.008. This translates to a 90% certainty interval ranging from 1 infection in 41 years to 1 in 1,100 years to with a mean of 1 infection in 130 years.

The results indicate that approximately 95% of the estimated risk to susceptible animals from illegal meat is associated with illegal meat arriving in personal baggage. However, there is evidence that meat is arriving in personal baggage in quantities that are destined for commercial use.

Of the estimated volume of contaminated illegal meat entering per year (95 kg), the majority does not actually reach livestock; in fact only 0.013% of the flow is ingested by susceptible livestock. Due to the various processes and delays inherent in the exposure routes, the level of FMDV associated with contaminated meat is also reduced through the stages from importation

through to livestock exposure. Consequently, the vast majority of does not reach livestock, with 0.01% of the total influx of virus per year ingested by livestock. Therefore, given the levels of contaminated illegally imported meat and meat products per year, the processes which occur inland following importation, for example distribution, human consumption and waste disposal, greatly reduce the level of virus to which livestock are likely to be exposed.

Once the meat has passed through all stages considered by the model, resulting in livestock exposure, it is most likely that infection will occur in pigs. Of the predicted levels of FMD infection per year, on average, 95% of the risk in susceptible animals from illegally imported meat is associated with pigs, 3% with cattle, 1% with sheep and goats and a negligible risk in 'backyard animals' (defined here as pigs).

A large proportion of the risk is attributed to exposure to FMDV contaminated bone-in fresh products and de-boned dried products, with ~71% of infections attributed to the import of such products. This suggests identification of these products either at ports of entry or inland at the distribution and retail level, and removal from the exposure chain, would mitigate the risk. However, sensitivity analysis shows that a general increase in the amount of illegal meat of all product types identified at the port of entry, and subsequently seized, has only a small impact upon estimates of risk.

Scenario analyses

Scenario analyses have been undertaken to assess those data deficiencies to which the final levels of uncertainty are sensitive. A time intensive process, the scenarios selected focus upon the pathways which contribute the most to risk, The most significant pathways inland contributing to the overall risk of infection are the various ways in which people might take or dispose of meat to rural areas or areas where there are livestock, including outdoor activities, illegal waste disposal and the direct feeding of animals for example at city farms or by farmers and farm workers. This pathway consists of all possible routes through the 'human carriage' node on the risk pathway (Figure 2) and accounts for just under 85%, on average, of the total risk; and illegal swill feeding accounts for, on average, just under 15%. There is an overlap of uncertainty between these two routes and it is not possible to be certain that the "human carriage" route dominates so clearly.

In addition, the feeding of scraps to backyard livestock is investigated to test the impact of underlying assumptions upon the contribution of this route to the final estimates or risk. The results of the analysis indicate that adjustment of current model inputs and assumptions may impact current estimates of risk, in particular in association with the 'human carriage' route.

Perhaps of particular importance to this audience is the fact that underlying the estimate of risk is an estimate of the levels of disease in each of the regions considered. This involves an estimation of the proportion of the animal population affected each year in the FMD-affected countries. Due to suspected under-reporting of disease occurrence an under-reporting factor

was estimated based upon available data, however there is considerable uncertainty associated with this estimate. To investigate the impact of the level of under-reporting upon estimates of risk, the level of under-reporting level was varied and the impact upon risk measure. The results of this investigation are given in Table 1 and summarised in Figure 3. This shows the impact of the detection efficiency, that is the rate at which infected establishments within a given country are identified and reported, demonstrating that an improved knowledge base regarding the levels of FMD throughout the world are essential to further refine estimates of the risk posed by illegal imports of meat.

This study was commissioned by the Animal Health and Welfare Directorate General of the Department for Environment, Food, and Rural Affairs (Defra), GB.

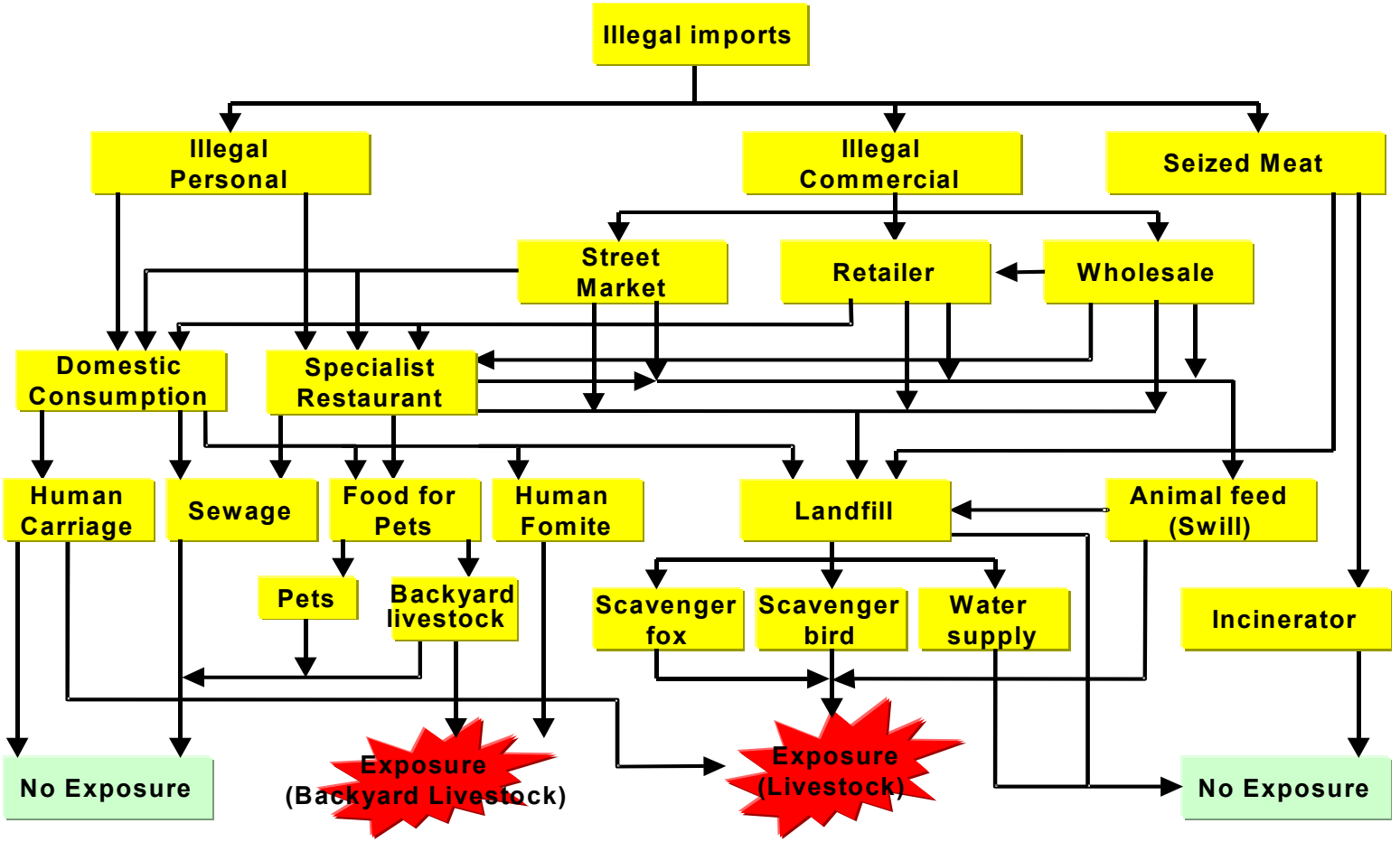


Figure 2: Model framework for the quantitative modelling of flow of illegal, contaminated meat from import to livestock exposure, both farmed and 'backyard' livestock

Table 1: Summary statistics describing the frequency of infection as a result of different detection rates

Detection rate	Mean	5th %ile	50th %ile	95th %ile
0.01	0.290	0.035	0.130	0.969
0.1	0.028	0.003	0.013	0.090
0.2	0.013	0.002	0.007	0.043
0.4	0.008	0.001	0.004	0.024
0.5	0.006	0.001	0.003	0.021

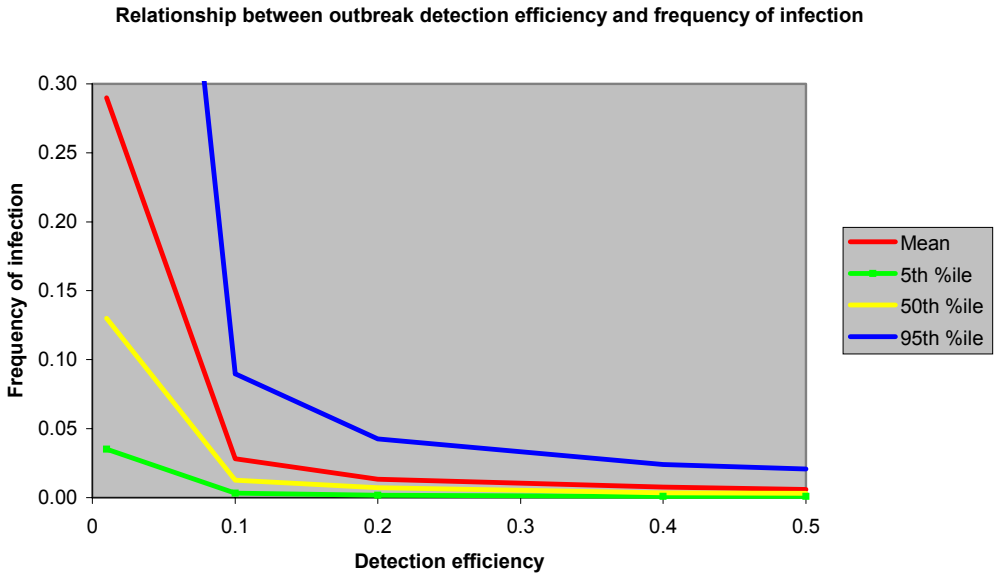


Figure 3: The relationship between the estimate of the frequency of infection and the detection efficiency of outbreaks