



Science Advisory Council

SAC Epidemic Diseases sub-group

SAC Review of exercise Hornbeam

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Note: The government has undertaken a highly successful review of its Foot and Mouth Disease (FMD) contingency plan, Exercise Hornbeam. This review took the form of a series of desktop exercises each building on data from previous events so that the national spread of a disease could be exercised realistically. Days 0-6 of the Suspicion, Confirmation and Regional spread phases of an outbreak were examined in ten tabletop exercises that tested the Government's plans and those of operational partners at strategic, tactical and operational levels.

The tabletop exercises, in advance of the 'real-time' simulation, provided a number of useful learning points and the data required for the final 'real-time' Exercise Hornbeam. The Science Advisory Council Epidemic Diseases sub-group was given the opportunity to review the science that underpins the plan in advance of the exercise and have formalised their recommendations.

The exercise culminated in a real-time invocation of Defra's response at Days 7 and 8 of an outbreak that involved the Defra Chief Scientific Advisor, Chair of the Science Advisory Council, Devolved Administrations of Wales and Scotland, other government departments, operational partners and several other external agencies. The following summarises scientific issues that need to be addressed in the short term.

This report has been signed off by the Defra Chief Scientific Advisor (Professor Howard Dalton) and the Chair of the Science Advisory Council (Professor Roy Anderson).

Issues arising from this report will be discussed at the SAC meeting on 19th July 2004.

1. Overview

- 1.1. This was an extremely valuable and useful exercise. It was well conceived, conducted and serviced, showing the professionalism of the Civil Service at its best. In general the tactics used during the exercise were excellent. Weak areas identified included strategy analysis, data analysis and information display.
- 1.2. A number of science issues were identified that require attention in the shorter term, many of these overlap with and build upon the recommendations of the Science Advisory Council Epidemic Diseases sub-group.

2 Modelling

- 2.1. Data, to be used for predictive modelling, was not available to independent experts in advance, or during, Exercise Hornbeam. This resulted in there being only one prediction model, Interspread, available. The code structure and assumptions of this model, constructed by a group in New Zealand and Canada, are not commonly understood and the absence of a key staff member, for very understandable reasons, removed the option of further modelling. In the event that Interspread had been used it would still have taken 24 hours to explore new policy options.
- 2.2. There is an urgent need to establish a consortium of independent, university based, experts working in 'peace time' to conduct rigorous simulations of the possible impact of different policy options, implemented in different regions, at different times post-day Zero of an outbreak. The results of these simulations should be published in peer-reviewed journals to ensure consensus regarding validity. The UK has an unusually high concentration of world leading expertise in this field and thus the establishment of such a consortium should not prove difficult.
- 2.3. A very clear statement of the prime policy aim must be made as this will dictate the model structure and output, i.e. quickest elimination of the epidemic, minimal animal deaths, minimal socio-economic impact etc.
- 2.4. In the event of an emergency it is essential that the CSA, SAC and independent modellers are provided with data in 'real-time' to enable the rapid simulation of

different policy options. The outputs of these simulations should be able to be displayed in graphical form to ease communication to a diverse audience, including at COBR.

2.5. The predictive model(s) used must provide day-by-day output of both predicted case numbers (Infected Premises) and logistical information (number to be killed, vaccinated, etc) and the case reproductive number 'R' (the average number of secondary cases generated by one primary case) to assess whether the epidemic is 'under control' in a rigorous scientific sense as opposed to a policy sense - i.e. meeting tactical targets for animal disposal etc.

2.6. A retrospective and detailed analysis of the 2001 epidemic should be undertaken to identify the characteristics of a farm that predispose it to infection (e.g., fragmented land parcels, etc).

3. Data capture

3.1. Problems were identified in relation to the type of data collected in the field, the mode and speed of transfer to the centre and the ability of independent experts to access the data in 'real-time'.

3.2. We recommend that independent experts need to be involved in data capture (web based entry, secure site). Analyses required include:

- the distribution of times to Infected Premises (IP) and Direct Contact (DC) removal, and for delivery of vaccine to a vaccine targeted herd;
- a Bayesian risk analysis of the factors that predispose a farm to infection and lead to an improved DC definition;
- the estimation of 'R' by spatial location, time, species etc.

3.3. The structure of the veterinary telephone report (FM1) and epidemiological assessment (FM21) forms requires further consideration. These forms need to be as simple and precise as possible. Field based digital entry systems should be developed to speed data transfer to the centre. Could commercially available hand held devices, e.g. "Blackberry", be used?

3.4. A mechanism that provides the proposed independent modelling consortium with easy access to the modelling data collected at the centre must be established.

4. **Strategy**

4.1. The definition of a DC is critically important in deciding the most appropriate control strategy. There is a clear difference of opinion between lawyers and scientists regarding this definition. Legally, a 'loose' definition of DC is desirable. For scientific purposes a very precise definition that is applied consistently is highly desirable.

4.2. Discussions to better define a DC should continue. This definition may require further revision during an epidemic depending on strain type, the origin host species involved, climate, location, etc.

4.3. As the definition of a DC improves, the volume of animals to be culled will rise, even under a vaccination policy. Thus the epidemiological models used must outline the benefits gained in reducing IPs according to the possible strategies that could be adopted i.e. IP removal, DC removal, Contiguous Premises culling and vaccination.

4.4. The duration of movement restrictions (6 days in England and Wales and 13 days in Scotland) should be reviewed, based on model simulations. Would a 13 day movement restriction have shortened the last epidemic and reduced its severity?

5 **Vaccination**

5.1. The exercise highlighted several scientific uncertainties related to the possible use of vaccination as part of the control strategy.

5.2. The logistics of vaccine supply, manufacture and delivery need to be more precisely defined. Before a decision to vaccinate is taken strategists must know how long it will take a company to scale up manufacture and replenish used stocks and how many doses can be delivered per day given widely separated spatial hot spots.

5.3. The science surrounding vaccine efficacy needs to be reviewed and summarised in 'peace time'. How long to protection in species A following vaccination with serotype B vaccine? How many doses of vaccine will be needed to effect protection, etc?

5.4. It remains unclear as to how disease in sheep would be controlled. In the event that the epidemic was self-sustaining in sheep, even if vaccinations were very successful in cattle, would CP culling need to be used?

6 Communication

6.1. In the event of an outbreak it is essential that we communicate accurately and informatively, being specific about terms such as 'Under control'.

6.2. Media presentation cannot exclude the use of R estimates. Science journalists know what the scientific definition of 'an epidemic under control' is and will undoubtedly ask the question. Similarly, it will be important to ensure that national experts outside of Defra are appropriately briefed on what Defra is doing and the science underpinning strategic decisions. The CSAs office will ensure the production of a daily e-mail of this scientific briefing.

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