

Environmental impacts of the foot and mouth disease outbreak in Great Britain in 2001: the use of risk analysis to manage the risks in the countryside

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Summary

Restrictions imposed for more than ten months throughout Great Britain in 2001 to control and eradicate foot and mouth disease (FMD) had a damaging effect on tourism and rural businesses. Risk assessment can play a valuable role in ensuring that the action taken is proportionate to the risk, and that countryside activities are allowed to resume when this can be done without compromising the objective of controlling and eradicating the disease.

A risk assessment unit was established at the commencement of the epidemic to consider the risks posed by particular activities, to identify ways of managing those risks, and to make recommendations which could be used by policy makers when deciding what action to take. The assessments produced by the unit were published and the scientific rationale which supported policy and procedural changes was thereby exposed to public scrutiny and criticism.

The author lists the activities subjected to veterinary risk assessments and describes how the process was used to consider public access to the countryside, leading to policy changes which within nine months resulted in the reopening of more than 96% of footpaths and bridleways without causing new outbreaks of FMD. A completed risk assessment is also included.

Keywords

Control – Countryside activities – Foot and mouth disease – Great Britain – Public access – Risk assessment – United Kingdom.

Introduction

The foot and mouth disease (FMD) epidemic which affected Great Britain in 2001 was unusual in many ways and unique in some. The primary outbreak in waste-fed pigs remained undetected for almost three weeks, and the virus plume spread infection to other farms in the vicinity. Sheep from these secondary outbreaks were sold at two markets in northern England, infecting other sheep in the markets. Infected sheep were then moved, some through other markets and premises of dealers, so that infection had been spread widely in England, Wales and southern Scotland even before FMD was known to have entered the country. In the first five days of the epidemic, outbreaks were confirmed in the south-east, north-east and south-west of England, and the Government clearly faced a serious problem and potentially, a major epidemic. The response was swift and, on the limited evidence then available, draconian.

The first outbreak was confirmed in a slaughterhouse on 20 February 2001 and the primary outbreak had been traced and was confirmed on 23 February. On the same day, all movements of FMD-susceptible livestock in Great Britain, including movements to slaughter, were prohibited. Infected areas were established around the outbreaks and the remainder of the country was placed under 'controlled area' restrictions which still remained in force ten months later. These restrictions, because of their severity and the unprecedented length of their application, had serious consequences for leisure activities in the countryside. The income derived from these activities is claimed to be more important to the rural economy than the agriculture to which the land is nominally devoted. This paper describes the use made of risk analysis in reviewing the emergency restrictions which had been imposed, to permit the resumption of countryside activities in ways which were consistent with meeting the over-riding imperative of controlling and eradicating FMD.

Countryside activities adversely affected by foot and mouth disease controls

Although Great Britain is largely an urban and industrialised society, three quarters of the land is still used to grow crops and raise livestock. The agricultural sector accounts for less than 2% of gross domestic product (GDP), of which a third is livestock production, whereas tourism accounts for the equivalent of approximately 5% of GDP. Only a small minority of the working population (2.2% or 0.5 million people) are directly engaged in agriculture, but many more who neither live nor work in country areas, as well as the minority who do, and visitors from overseas, use the countryside for a variety of leisure pursuits. The restrictions imposed to control FMD have had an impact far beyond those individuals whose livelihood is directly dependent on keeping and marketing livestock and their products. For example, the diminution of visitor numbers damages the profitability of hotels and other providers of accommodation, of public houses and of local shops.

Tourism in Great Britain is a major industry, and the income it produces is particularly important in the ten National Parks in England and Wales, which were set up to provide access to the land for public enjoyment. An unfortunate feature of the epidemic is that many of the outbreaks occurred on farms in seven of the parks. Many tourists choose to walk in the areas they visit and the freedom to do so may be their main, or only, reason for visiting. The restrictions imposed to control FMD severely limited the activities of those who normally walk for pleasure. There are over 190,000 km of public rights of way in England and proportionate networks in Scotland and Wales. Some are little-used field paths, but many are critical to attracting visitors to the countryside, particularly to coastal and hill areas. When access is denied, the number of visitors falls, affecting the many local businesses which are viable only because of the income derived from tourism.

Other countryside activities were also adversely affected by the epidemic. They included the following:

- shooting game birds and wildfowl, which has become a major corporate leisure industry employing 25,000 people and generating an estimated annual turnover of £600 million. This activity attracts many overseas visitors who may pay up to £3,000 for a day of shooting
- falconry: there are 2,000 active falconers in Great Britain, and some 10,000 registered keepers
- hunting with dogs: more than 300 packs of hounds are normally active in the United Kingdom (UK), and many thousands of individuals use their dogs for pest control and recreational purposes; some 20,000 hunting days are arranged each year by the principal hunting organisations, attracting

more than a million people to the meets. A 1998 study calculated the total annual expenditure specific to fox hunting at £243.1 million

- point-to-point racing on agricultural land: this activity is closely related to hunting, and 189 of the 209 meetings each year are organised by the hunts
- coursing
- deer stalking
- angling
- pleasure boating on inland waterways
- visits to historic houses and other attractions.

The initial response

The legislation in place when the outbreak started in February 2001 dated from 1983 and, *inter alia*, implemented recommendations made in the report of the Committee of Inquiry on FMD (the 'Northumberland Report') published in December 1969 after the last major epidemic of FMD in Great Britain (1). The Committee did not envisage controlled area restrictions being in force for prolonged periods, viewing them as a temporary measure to allow the tracing of suspected in-contact animals, although the Committee did recognise that exceptionally they might have to be applied extensively or over a prolonged period. The Committee recommended that outdoor activities should normally be allowed in controlled areas, with only deer hunting and stalking being prohibited. The 1983 Order reflected this advice.

The situation at the end of February 2001 was certainly exceptional. Infection had been widely distributed in sheep, the movements of which are difficult to trace and in which clinical disease is notoriously difficult to diagnose. Given the uncertainty about the extent to which FMD had spread throughout Great Britain, the whole country was declared to be a controlled area. Restrictive measures could then be imposed in accordance with the statutory provisions in the Order, not just in the infected areas, but throughout the country. The Order could also be amended to provide additional powers and on 27th February, local authorities were given statutory power to close footpaths in controlled areas (they already had that power in infected areas), subject to clearance by the Ministry of Agriculture, Fisheries and Food (MAFF). Other countryside activities which were dependent on access to farmland, such as hunting, hawking and falconry, shooting game and other wildlife, racing or coursing with dogs, and certain equestrian events, were already prohibited by statute in infected areas, and such activities were voluntarily suspended and many visitor attractions were closed elsewhere, whether there was a risk of contact with livestock or not. Hunting of any species in a controlled area was prohibited by statute from 16 March.

Irrespective of actual closures, public access to farmland in any part of the country was strongly discouraged. The Prime Minister explained the stance of the Government in an internet broadcast on 27 February, saying the following:

'Foot and mouth disease is a highly infectious virus which can be picked up by us on our boots, clothes and cars and carried many miles. By staying away from farmland, by keeping off any footpaths through or next to farms or open land with livestock, we can help the efforts to eradicate this disease. We are giving local authorities today the power to enforce the temporary closure of footpaths and rights of way, but we hope that people will voluntarily stay away in any case.'

At the same time, the president of the National Farmers' Union argued for the immediate closure of all rural footpaths, saying the following:

'Remember, the disease could be anywhere – not just in the restricted zones. I implore everyone once again; please, please stay away from the countryside.'

Having been given the power to close footpaths, and been strongly encouraged by the Government and farmers' representatives to use this power, most local authorities did so. Many used new powers which enabled them to close all paths in the areas for which they were responsible without having to erect notices on individual paths and, by early March, almost all footpaths were closed.

The damaging impact on tourism and the businesses that depend on it, especially in popular walking areas such as the Lake District, rapidly became apparent. In some areas, visitor numbers fell to zero. There were also some unanticipated side-effects, such as reports of children having to walk long distances along busy roads to get to school. The action which had been taken had to be reconsidered, to decide whether that action was proportionate to the risk and whether alternative control measures could be identified which would prevent the spread of disease to uninfected premises whilst allowing the resumption of at least some countryside activities.

The establishment of a risk assessment unit

In the initial response to the outbreaks, most countryside pursuits, as well as all movement and marketing of FMD-susceptible animals, even to slaughter for human consumption, had been prohibited – and those which were not prohibited were strongly discouraged. At the beginning of March 2001, the Chief Veterinary Officer decided to establish a risk assessment unit in Head Office. The task of the unit would be as follows:

- to consider the risks posed by particular activities

- to identify ways in which those risks could be managed, and
- to make recommendations which could be used by policy makers when deciding what action to take as the epidemic progressed.

The risk assessments produced by the unit would be published on the Government website, consistent with the report of the findings of the committee established to inquire into bovine spongiform encephalopathy (BSE). This had concluded that a policy of openness is the correct approach when communicating risk to the public, even in a situation where some uncertainty exists. Publication exposed the scientific rationale which supported policy and procedural changes to public scrutiny and criticism in a way which had not been done before in the context of State control of an epidemic of animal disease.

Risk analysis has been routinely used by Government as a systematic aid to decision-making for many years. In the veterinary sphere, risk analysis was first applied to import/export problems, rather than to domestic disease control. A risk research department had been established at the Veterinary Laboratories Agency (VLA) in 1997, in response to a rapid increase in the number of requests to the Agency from Government and commercial organisations for risk analysis methodology to be applied to veterinary and public health issues. The department is staffed by a multi-disciplinary team including veterinarians, mathematicians, microbiologists and a psychologist, and has an extensive network of national and international partners in other research institutes and universities. Despite having no specific expertise in FMD, the department was able to make an important contribution to the work of the new risk assessment unit, which was headed by a veterinarian with wide field and head office experience, who could also draw on the experience and advice of colleagues in the State Veterinary Service and at the Institute of Animal Health Laboratory at Pirbright. After some initial experimentation, it was clear that there was little benefit in requiring members of the unit to work as a group in one place and individual members thereafter remained in their usual workplaces, communicating by telephone and e-mail, under the direction of the head of the unit.

In the period up to 30 November 2001, the unit completed and published the 26 veterinary risk assessments (VRAs) listed in Table I. Revised versions were also published where developments in the epidemic and changes in other control measures made this appropriate, and some VRAs were amended on a number of occasions. As will be apparent from Table I, not all the subjects considered were of equal importance and in a few cases, a simplified approach was taken. In most cases, however, the first step was to commission a formal analysis of the risk under consideration from the VLA risk research department. As well as completing a formal risk analysis, in some cases a lengthy document, the department

Table I
Foot and mouth disease veterinary risk assessments published between March and November 2001 (2)
 Veterinary risk assessments relating to countryside activities are presented in bold type

VRA No.	Veterinary risk assessment (VRA) title	Assessment revised on one or more occasions
1.	What is the risk of causing new outbreaks of foot and mouth disease (FMD) by moving livestock from one farm to another?	Yes
2.	What is the risk of causing new outbreaks of FMD by moving livestock from their place of slaughter to a different place for disposal?	Yes
3.	What is the risk of causing new outbreaks of FMD by allowing bulk feed deliveries to farms under Form D restrictions?	No
4.	What is the risk of causing new outbreaks of FMD if footpaths are open to the public?	Yes
5.	What is the risk that feral deer on infected premises will cause outbreaks of FMD on other premises?	No
6.	What is the risk of causing new outbreaks of FMD by moving sheep from a farm where animals have been exposed to the risk of infection, to an alternative place for slaughter, and from there to a further place for disposal?	No
7.	What is the risk of feral wild boar becoming infected with FMD and subsequently causing new incidents of FMD in domestic livestock?	No
8.	What is the risk of causing new outbreaks of FMD if animals are slaughtered and their meat and waste products are distributed through the normal channels?	No
9.	What is the risk of causing new outbreaks of FMD if deer parks are open to the public?	No
10.	What is the risk of causing a new outbreak of FMD by staging a horseracing meeting?	Yes
11.	What is the risk of causing new outbreaks of FMD if farm visits by Ministry of Agriculture, Fisheries and Food (MAFF) staff are resumed?	Yes
12.	What is the risk of causing a new outbreak of FMD by staging a specified equestrian event on agricultural land?	Yes
13.	What is the risk of causing new outbreaks of FMD by moving hay and straw onto a farm?	No
14.	What is the risk of causing a new outbreak of FMD by staging an official equestrian event on non-agricultural land?	Yes
15.	What is the risk of causing new outbreaks of FMD as a result of sheep shearing?	No
16.	What is the risk of causing new outbreaks of FMD by allowing farm shops to open?	No
17.	What is the risk that car boot sales on agricultural land will cause new outbreaks of FMD?	No
18.	What is the risk of causing new outbreaks of FMD through collection and transport of bull semen and artificial insemination of cows?	No
19.	What is the risk of causing new outbreaks of FMD if grouse shooting is permitted?	No
20.	What is the risk of causing new outbreaks of FMD as a result of sheep dipping (later revised to include other sheep husbandry practices, including ultrasound scanning)?	Yes
21.	Should transmissible spongiform encephalopathy (TSE) experimental animals be vaccinated against FMD?	No
22.	What is the risk of causing new outbreaks of FMD by allowing 'Pick your own' operations on farms?	No
23.	What is the risk of causing new outbreaks of FMD if shooting of pheasants and partridges is permitted?	No
24.	What is the risk of causing new outbreaks of FMD if wildfowling is permitted?	No
25.	What is the risk of causing new outbreaks of FMD if falconry is permitted?	No
26.	What is the risk of causing new outbreaks of FMD by hunting with dogs?	No

Copies of the full assessments, including the unpublished annexes, can be supplied on request by Dr F.J. Landeg, Head of Veterinary Exotic Diseases Team, DEFRA, 1A Page Street, London SW1P 4PQ, United Kingdom

also prepared a summary of the risks which had been identified in the full analysis, drawing particular attention to the most important of these risks. This summary formed the first of three parts in the published risk assessment.

The second part of each published VRA sets out possible risk management options, irrespective of whether they were considered to be either practicable or proportionate to the risk being considered. The objective was to ensure that all possible theoretical risk management options had been identified and that no risk had been overlooked. The third part of the published VRA recommended the action to be taken, and took full account of practicability and proportionality. The names of the contributors to each VRA were also published. An example

(without the names of contributors) is included as an Appendix to this paper.

In making recommendations, the objective was to identify ways in which particular activities could be pursued by farmers or the public whilst minimising any risk of causing further outbreaks of FMD in the context of and consistent with the various disease control measures in force – for example, protection and surveillance zones, and infected and controlled areas. Any action involves some risk and when deciding what action to recommend, the complete elimination of risk was not considered to be a realistic objective. As the epidemic waxed and then waned as control measures took effect, and disease was eradicated in some areas only to appear in others, the

background against which the recommended risk management measures were applied also changed. Activities which would have carried too great a risk to be permitted in the early stages of the epidemic, could be resumed in a restricted form at a later stage, and with even fewer restrictions later still.

In the remainder of this paper, the use made of VRAs in deciding whether and under what conditions footpaths could be reopened and public access to the countryside allowed, is taken as an example of how the process was employed to assess the risks posed by the activities listed in Table I, and how this contributed to developing control policies.

Controlling public access to the countryside

When the FMD epidemic commenced in 2001, British legislation provided power for an inspector to close footpaths in an infected area by displaying a notice prohibiting access at every entry to the land across which the footpath ran. Given the number of footpaths in most areas, this was a time-consuming activity, demanding considerable manpower resources. The legislation did not provide the power to close footpaths outside the infected areas, and had to be amended before this could be done. In fact, the 1983 Order has been amended 13 times since the epidemic began and a number of these amendments were needed to implement changes recommended following a VRA. The powers available to close footpaths were changed several times.

The first amendment came into force on 27 February 2001, when an inspector was given the power to prohibit entry to any land or building in a controlled area, irrespective of the existence of any footpath or right of way. As was the case for an infected area, a notice had to be displayed at every entrance to the land. As the whole of Great Britain was by this time declared to be a controlled area, the new power enabled any footpath in the country to be closed. This power was refined by a further amendment which came into force on 2 March. From this date, local authorities could make regulations to prohibit the movement of any person onto any footpath or right of way if the Minister had confirmed FMD in any part of their territory. Local authorities where FMD had not been confirmed could take the same action after consultation with the Minister. These changes made it much easier to close all footpaths over wide areas, and almost all were closed.

On 16 March, the power given to local authorities to close footpaths by making regulations was rescinded and their power to close paths in controlled areas was restricted. From this date, an inspector had to obtain the written consent of the Minister before prohibiting entry to land or buildings in a controlled area, irrespective of the existence of any footpath or right of way, and if consent was given, a notice had to be displayed at every

entrance to the closed path. This change coincided with the preparation and publication of VRA No. 4, which recommended that footpaths and bridleways in controlled areas should be open to most members of the public, provided that certain precautions were observed. Despite this advice, many local authorities adopted an ultra-cautious approach and kept most of their footpaths closed. Since the amended legislation contained no requirement to revoke closure regulations which had already been made by local authorities, publication of the risk assessment and forceful advice from the Government initially had only a limited effect. By Easter, which fell in the middle of April, only 14% of paths in England were open.

The VRA was reviewed during April, and a revised version was published on 23 May (see Appendix). The assessment now recommended that, subject to precautions being taken, all footpaths which did not cross or pass within 3 km of infected premises should be reopened. Once again, the Government encouraged local authorities to follow guidance and act in accordance with the revised risk assessment. Many had by this time come to appreciate the damage being done to rural economies by restrictions which had now been in place for three months; the response was better and more paths were reopened. Other local authorities, including some which had never had a case of FMD, remained impervious to advice and kept their paths closed. By the late May public holiday, 42% of English paths were open. The figure showed a marked improvement in July, when the Government further amended the 1983 Order and took power to revoke blanket closures by a declaration of the Minister, published in such manner as he saw fit. By 20 July, 85% of English paths were open (Table II).

By the beginning of October, 92% of paths in England were open, a figure which had increased only slightly by the end of November. In many areas all paths were open, but in areas

Table II
Progress in reopening footpaths following the foot and mouth disease epidemic in Great Britain in 2001

Date (2001)	Veterinary risk assessment published	Footpaths open (%)
Early March		0
22 March	VRA4/1	<10
15 April (Easter)		14
17 May		26
23 May	VRA4/2	31
28 May (public holiday)		42
25 June		64
20 July		85
22 November		93
6 December	VRA4/3	>96

VRA: veterinary risk assessment

where there had been many outbreaks, such as the Lake District and Yorkshire Dales National Parks, the figures were lower (75% and 69%, respectively). Access to infected premises is prohibited except under licence and paths which crossed premises that were still subject to restrictions had to remain closed. A considerable proportion would have stayed closed for many more months if the policy had not been changed following further revision of the VRA to take the latest information about the epidemic into account. Early in December 2001, it was agreed that paths which crossed land on restricted premises, but did not pass through farm yards or buildings, could be reopened after the premises had been cleansed and disinfected, or after a suitable time interval.

The use of risk assessments in restoring countryside activities

By the time the risk assessment unit was set up at the beginning of March 2001, almost all footpaths and bridleways in Great Britain had been closed. One of the first tasks of the unit was to identify the risk factors which were involved when walkers used footpaths and the options for managing those risks and to consider whether, and in what circumstances, some or all footpaths might be reopened. Although VRA No. 4 was published on 22 March 2001, and concluded that transmission of infection by people had been recorded on many occasions, those responsible had usually been in close contact with infected and then uninfected animals. Walkers could theoretically carry infection to previously uninfected animals, although there was no evidence that this had actually happened and the risk was considered to be small when compared with other transmission risks. The assessment therefore concluded that there was no veterinary justification for closing all footpaths and preventing all public access to land. The assessment suggested a more measured response, which took account of the real risk as well as public perception of risk, and noted that the real risk varied according to location and land use. The assessment recommended that although the actual risk was small, public access to land in infected areas should continue to be prohibited, but that footpaths and bridleways in controlled areas should be open to most members of the public, subject to a number of listed precautions being taken. As already noted, publication had a very limited effect.

The epidemic peaked at the end of March 2001, and by the end of April the number of outbreaks confirmed each day had fallen to single figures. The damaging impact of the closures on countryside tourism and the businesses that depend on it had become more apparent, and the Government policy had changed from the initial response of asking people to stay away to encouraging them to return to areas when it was considered safe for them to do so. A number of new concepts had been introduced. Different parts of the controlled areas had been designated as being 'provisionally free' or 'at-risk', principally

for the purpose of managing animal movements to preserve the disease-free status of the 'provisionally-free' areas, and these and other changes needed to be reflected in the VRA.

A revised version of VRA No. 4 was prepared and published on 23 May 2001. This version recognised that viable virus was most likely to be picked up on premises which had only recently been infected, whether by human, animal or product movement, or as a result of proximity to another infected premises, and that the risk of coming into contact with viable virus was higher in an infected area than in a controlled area. Whatever the status of the area, there was only a very small risk that walkers who had not recently handled or been in contact with susceptible livestock would introduce infection from elsewhere, or spread infection from one premises to another whilst walking. It therefore suggested that, for as long as FMD remained in Great Britain, the single most effective method of reducing any risk posed by walkers would be to ensure that they had not handled or been in contact with susceptible livestock before or during their visit.

To be sure that walkers or anyone else will invariably follow rules is, of course, impossible in a free society. Most, however, will follow advice in their own interest (the alternative may be no access at all) and in the interest of the community at large. The revised risk assessment therefore recommended that public access to infected premises and land within 3 km of those premises should be prohibited, but that public access to all other paths, bridleways and open land in an infected area should be allowed on the basis that precautionary measures would be publicised and walkers would be asked to co-operate by observing them in their own interest and in the interest of the farmers who owned the land. A copy of the full assessment forms the Appendix to this paper although, in common with all other risk assessments carried out by the unit, only Parts 1-3 were actually published on the Government website. The formal risk analysis prepared by the VLA Risk Research Department formed an annex to the published assessment, and a copy was given only to those who asked for one.

The footpath risk assessment was further revised in November 2001, to include reference to new control concepts such as the restricted infected areas, introduced by an amending order on 30 July. The importance of eliminating risk in these areas of active disease was recognised by recommending that all footpaths across agricultural land in a restricted infected area be closed for as long as the area restrictions remained in force.

Consideration was also given to the prolonged closure of footpaths across premises on which all susceptible livestock had been destroyed and restrictions still remained in force. The revised VRA recommended that paths which crossed land on restricted premises – but did not pass through farm yards or buildings – could be reopened after cleansing and disinfection of the premises had been completed. If full cleansing and disinfection was not being undertaken, paths across land could

be reopened three months after the completion of preliminary cleansing and disinfection. All other restrictions applied to the premises remained in force until the restrictive notice had been withdrawn. Yards and buildings were excluded because they provide a protected environment in which virus is able to remain viable for longer periods than outdoors. Wherever possible, paths which normally passed through yards and buildings were diverted with the agreement of the landowner and reopened, but where agreement could not be reached, the path had to remain closed until restrictions had been withdrawn. These changes, together with the absence of new cases, the lifting of restricted infected area restrictions, and the removal of restrictions from individual infected farms, allowed most footpaths to be open before the start of the 2002 holiday season.

The use of risk assessment in considering other countryside activities

The methods used to consider the risks posed by footpaths and public access to the countryside were also followed when assessing the risks associated with the remaining countryside activities listed in bold type in Table I. However, the risk management measures recommended and adopted varied. In many cases, tighter controls were implemented where the activity took place in an infected area by introducing a licensing system under veterinary control. In other instances, such as hunting and coursing with dogs, the activity had to be limited to counties which had been designated as FMD-free, under a permit system. The hunting of deer (the only FMD-susceptible species which is hunted in Great Britain) remains prohibited for as long as area restrictions remain in force in that part of the country.

Conclusions

Some restriction on normal countryside activities is inevitable if FMD is to be controlled by stamping-out without recourse to vaccination. In the short term, even the most severe restrictions do only a limited amount of damage to rural businesses, but restrictions which are maintained for long periods of time may have serious consequences and the losses suffered by rural businesses may be greater than the losses suffered by the farmers themselves. Adequate control measures must be imposed to limit the spread of infection, and equally important, those controls must be proportionate to the risk and be removed or modified as soon as it is safe to do so. Particular risks have to be considered in the broader context of the epidemic, and recommendations must be both practical and take account of all the different control measures in place. Compliance with controls, particularly by the general public, is more likely if the reasons for taking the measures are clearly explained and understood. A simple, clear published assessment of risks, and the control measures which will minimise them, will assist the educational process.

Deciding what to do, how, and for how long are difficult questions. There is an understandable tendency to over-react in the early stages of an epidemic and experience shows that controls are much easier to impose than to relax or remove. The experience of Great Britain in 2001 suggests that risk assessment techniques can play a valuable role in identifying the risks which are implicit in particular activities, and suggesting ways – and perhaps a variety of different ways – in which those risks can be managed so that an epidemic of exotic disease can be effectively controlled by measures which do the least possible damage to agricultural and rural businesses.

Appendix

Veterinary Risk Assessment No. 4 (revised version published on 23 May 2001) (2)

What is the risk of causing new outbreaks of FMD if footpaths are open to the public?

Part 1. Summary of risks identified in full assessment (see Annex)

If footpaths are open to the public, there is a risk that new outbreaks of FMD will occur. Infection may result from contaminated persons or accompanying animals arriving at the footpath and subsequently passing on infection to livestock, or by persons or accompanying animals becoming contaminated while in the locality of the footpath and passing on infection to livestock then or at a later time.

The factors considered to be most responsible for increasing this risk are:

- contact with infected premises or premises where animals have been exposed to the risk of infection prior to arrival at footpaths

- contact with livestock prior to arrival at footpaths
- failure to disinfect footwear prior to arrival at footpaths
- proximity of the footpath to livestock areas, including infected premises and premises where animals have been exposed to the risk of infection
- presence of accompanying animals
- failure to limit access for persons or accompanying animals from footpaths to livestock areas
- failure to limit access for livestock to footpaths, resulting in deposits of faeces, urine, milk, etc.
- contact with livestock while in locality of footpaths
- contact with surroundings (including pasture and foliage) while in locality of footpath
- meteorological and environment conditions which influence virus survival
- failure to disinfect footwear after leaving locality of footpaths
- contact with livestock after leaving locality of footpaths
- contact with surroundings (including pasture and foliage) after leaving locality of footpath.

Of these, the major factors are:

- proximity of the footpath to livestock areas, including infected premises and premises where animals have been exposed to the risk of infection
- contact with livestock prior to arrival at footpaths
- contact with livestock while in locality of footpaths
- contact with livestock after leaving locality of footpaths
- failure to limit access for livestock to footpaths, resulting in deposits of faeces, urine, milk, etc.

Part 2. Summary of risk management options

This section identifies ways in which the risks which have been identified can be managed, taking no account of whether the management options are practical or proportionate to the level of risk. Theoretical risk management options include:

- a) closing all footpaths over land which may be grazed by livestock, making public access a criminal offence
- b) closing footpaths only in areas where the risk of FMD virus being present is greatest
- c) preventing or discouraging access by those who keep or handle susceptible livestock in the course of their work, and so are most likely to have been exposed to and contaminated by FMD virus
- d) permitting access but encouraging the public:
 - to wear clean clothing and footwear so that they do not introduce infection to an area
 - to avoid walking amongst livestock, and, in particular, NEVER to handle or touch animals, and
 - to use any disinfectant footbaths or pads which the landowner may choose to provide
- e) regulating access in accordance with the likelihood that infected animals or their products may be encountered. The risks are greatest on Form A and Form D premises,

but these are already controlled by statute. Elsewhere the risk diminishes with distance as follows:

- within 3 km of an infected premises
- within an infected area
- within an 'at-risk area' in a controlled area
- within a 'provisionally-free area' in a controlled area
- where no FMD controls are in force.

Part 3. Recommended action

a) FMD virus may be introduced to previously uninfected premises in many ways: by airborne spread; by the movement of infected animals, feed or bedding; and by the movement of people or equipment contaminated with the virus. Transmission by people has been recorded on many occasions, but those responsible have generally had close contact with animals on infected, and then on uninfected, premises. It is theoretically possible that walkers could carry infection to previously uninfected animals, although there is no evidence that this has actually happened and the risk, if any, is small in comparison to other transmission risks.

b) Even small risks can be further diminished by appropriate action, but the cost may outweigh the benefit. There is a balance to be struck between the need to control FMD and the damage that controls do to other important industries, such as tourism. Draconian action may be unnecessary and inappropriate, particularly if universally applied.

c) There is no veterinary justification for closing all footpaths and preventing all public access to land. A more measured response, which takes some account of both public perception and of the real risk, is required. The latter is the product of many factors, including the prevalence of infection in an area, the presence or absence of susceptible livestock, and the density of the livestock if present.

d) Viable virus is most likely to be picked up on premises which have been recently infected or exposed to the risk of infection by human, animal or product movement, or by proximity. Where infection is suspected or has been confirmed such premises are subject to Form A or Form D restrictions respectively, and access is prohibited by these restrictions. Elsewhere, infection may be present but unrecognised. In diminishing order of risk we have premises in infected and controlled areas (the latter divided into higher and lower risk), and at some future date, in areas not subject to any FMD controls.

e) Whatever the status of an area there is only a very small risk that walkers who have not recently handled or been in direct contact with susceptible livestock will introduce infection from elsewhere, or spread infection from one premises to another. The risk is greatest on land close to an infected premises on which FMD has recently been confirmed and diminishes with time. A high density of livestock increases the likelihood of contact between walkers and animals, and so increases any risk of transmission.

f) The FMD epidemic is now in sharp decline; the weather is warmer and becoming drier. Although a few cases continue to occur, some infected areas, or parts of infected areas, have had no confirmed cases for many weeks. Virus excretion is localised and infrequent, and any virus which is on pastures will not survive for as long as it did in the winter months.

g) For as long as FMD remains in Great Britain the single most effective method of reducing any risk posed by walkers is to ensure that they have not handled or been in contact with susceptible livestock before or during their visit. These individuals cannot

be excluded by statute, but may be amenable to following advice in the interest of the community at large.

h) On the basis that this assumption is correct, the following action can be justified in infected areas at this stage of the epidemic:

- Prevent public access to infected premises and land within 3 km of those infected premises.

- Allow public access to all other paths, bridleways and open land, but publicise and seek the cooperation of walkers in observing the following precautions for the benefit of both farmers and walkers:

- do not enter if you have handled cattle, sheep, goats or pigs in the last seven days
- start your walk wearing clean footwear and clothing
- do not stray from the right of way onto adjoining land
- do not approach, and never touch or handle, livestock
- do not walk dogs, even on a lead, where there may be cattle (because cattle are curious and approach dogs, and it may then be impossible to avoid contact with them)
- take any waste, including food, home
- use any disinfectant footpads or baths which the landowner provides.

i) It is extremely unlikely that walkers will come into contact with viable FMD virus in any part of a controlled area. The risk of transmission from one farm in the area to another is therefore vanishingly small, but it is possible that infection may be introduced from elsewhere. At this stage of the epidemic the following action can be justified in a controlled area:

- Allow public access to all paths and rights of way, but publicise and seek the cooperation of walkers in observing the following precautions intended to protect the disease-free status of the area:

- do not enter if you have handled cattle, sheep, goats or pigs in an infected area in the last seven days
- start your walk wearing clean footwear and clothing
- do not approach, touch or handle livestock
- keep dogs on a lead wherever there are livestock
- take any waste, including food, home
- use any disinfectant footpads or baths which the landowner provides.

Annex

Risk assessment for the question: 'what is the risk of causing new outbreaks of FMD if footpaths remain open to the public?'

This risk assessment considers the various steps that are required for a new outbreak of FMD to occur. The probability of a new outbreak is dependent on the combined probabilities of each of the individual steps occurring. For each step, the important factors are described and an assessment is made of their influence on the associated probability. An assessment of the magnitude of the probability is not made unless available evidence has been presented. The overall result is a summary of the factors which have the greatest influence on the probability of a new outbreak. These factors should be considered when a risk management decision is made.

For the purpose of this assessment, we are assuming that footpaths constitute any rural place where the general public may walk. These individuals may also be accompanied

by animals, for example, dogs and horses. Footpaths in all areas of GB are included. At any time, individuals or animals may leave the footpath and enter other land. Such land includes farmland, wooded areas, etc. Contamination of persons includes clothing.

Where appropriate, expert advice used in this assessment has been taken from previous FMD risk assessments carried out by the agency. This advice is by personal communication from:

- A.I. Donaldson (FMD World Reference Laboratory, Pirbright, UK, March 2001).
- R.P. Kitching (FMD World Reference Laboratory, Pirbright, UK, March 2001).

1. Probability that person or accompanying animal is contaminated at the time of first access to the footpath and probable amount of contamination

Factors which are likely to affect this probability and amount	Comments and risk estimate if/where appropriate
History of previous movements of person or animal	Probability and amount increase with increasing proximity to infected premises (IPs) or dangerous contacts (DCs); amount decreases with decreasing proximity; proximity will depend on occupation of person and others in household, e.g. farmers, veterinarians, and participation in sports involving animals
Recent contact with livestock animals (if these animals are infected)	Both increase with likelihood of contact; dependent on species of animal, possible stage of infection of those animals, whether or not animals have been slaughtered, slaughter method used and disinfection procedures
Disinfection prior to arrival at footpath	Both decrease if disinfection of footwear and clothing has been undertaken
Animal food products	Probability will increase if person has animal food products, e.g. ham sandwich; probability of contamination will depend on source

References/expert opinion

Information relating to contact with livestock animals and disinfection has been supplied in a previous assessment.

Conclusion

The probability of a person or accompanying animal being contaminated at the time of arrival at the footpath and the probable amount of virus depend, primarily, on their previous movements, particularly their level of contact with livestock animals, which in turn depend on occupation and participation in sports involving animals. The probability and amount will be highest if they have been in close proximity to infected premises (IPs) or dangerous contacts (DCs) and can be reduced if disinfection of footwear and clothing is undertaken. The probability of objects such as animal food products being contaminated will depend on the source of the product.

2. Probability that person or accompanying animal leaves footpath and enters other land

If a person or animal leaves the footpath and goes onto other land, there is a risk that this land may be closer to an infected area, have infected animals on it or itself be contaminated.

Factors which are likely to affect this probability	Comments and risk estimate if/where appropriate
Location of footpath	Increases if open fields are in locality
Ease of access	Increases if fields are accessible; will also increase with increasing number of access points
Presence of restricted area	Decreases if visible notification of restricted area
Animals accompanying	Accompanying animals, especially dogs, are likely to leave footpath if not on leads; their presence therefore increases probability

Conclusion

The location of the footpath and the ease of accessibility have the greatest influence on the probability of persons or accompanying animals leaving the footpath and entering surrounding land. Accompanying animals are likely to leave the footpath, if not on leads; hence if they are present, the risk will increase.

3. Probability that person or accompanying animal becomes contaminated as a result of being on footpath

Contamination of individuals/accompanying animals may occur either while on the footpath, or while on other land if they have left the footpath (step 2 above).

3.1. Probability of infection/contamination in locality of footpath and probable amount of infection/contamination

As all areas within GB are being considered, within the locality of the footpath, there may be infected farms, both identified and not identified, and contamination of land and foliage. Contamination will have occurred as a result of release of infection at a prior time. Current release of infection is considered in the next step.

Factors which are likely to affect this probability and amount	Comments and risk estimate if/where appropriate
Proximity to IPs or DCs	Both increase with increasing proximity to IPs or DCs
Proximity to infected livestock premises	Both depend on probability of premises being infected (an assessment of this probability and amount was included in a previous risk assessment); if infection is present contamination of environment is likely via, e.g. faeces, milk, vesicular fluid and aerosol deposition
Topography, soil type and plant type surrounding footpath	Land and foliage favourable for virus survival will increase probability and amount
Level of use of footpath and surrounding land	Increases with increasing level of use
Proximity of car parks	Infection may be transported via vehicles; hence both increase with proximity to car parks
Wildlife in locality	Wildlife may carry virus; thus their presence increases probability and amount; hedgehogs have been suggested as susceptible
Presence of animal excrement or milk on footpath or other land	Virus may be present in animal excrement and milk; thus presence will increase probability
Accessibility for livestock (perimeter security)	Livestock from surrounding premises may have access to footpath, from "escape" or during movement from one place to another; probability increases with level of access
Meteorological conditions	Favourable conditions (relative humidity>60%, medium strength wind and inversion) will increase probability of survival and thus probability of contamination being present

IP : infected premises
DC: dangerous contacts

References/expert advice

Information on favourable topography, soil types and meteorological conditions and role of wildlife in release of virus has been supplied separately.

Level of virus in milk is reported to be between 10^4 and $10^{6.6}$ TCID₅₀/ml. Survival of the virus in milk depends on pH and temperature.

Conclusion

The probability of there being infection/contamination in the locality of the footpath and the probable amount are most dependent on the location of the footpath. In particular, the probability and amount will increase with increasing proximity to IPs, DCs and other places where livestock are present. The probability can be reduced if there is no or limited access for livestock, for example via perimeter security.

3.2. Probability of release of infection and probable amount released (given infection in locality)

Information about virus release from infected farms (both IPs and farms not yet identified as infected) has been supplied for a previous assessment.

Conclusion

The probability and amount of infection released from IPs and DCs is primarily dependent on the species of livestock, the stage of pathogenesis, the number of infected animals, whether or not they have been slaughtered, the method of slaughter and disinfection procedures.

3.3. Probability of exposure and subsequent contamination of persons or accompanying animals

Factors which are likely to affect this probability	Comments and risk estimate if/where appropriate
Proximity to IPs and DCs	Increases with increasing proximity to IPs or DCs
Proximity to livestock	Increases with level of contact with livestock either on footpath or in locality
Level of access to other land	Increases with increased access; will be especially high if access to farmland, particularly IPs and DCs
Behaviour of persons or accompanying animals	Increases with level of contact, e.g. walking, with environment, particularly foliage; probability is likely to be higher if there are accompanying animals
Presence of wildlife	Wildlife may distribute or carry the virus, the risk increases with greater numbers and is influenced by the behaviour of wildlife
Presence and movement of other fomites	Both will increase if moving vehicles, e.g. farm vehicles, are in locality; litter may also contribute to virus spread
Survival of virus in environment	Will be affected by soil type, pH, origin (e.g. excrement, milk, vesicular fluid, aerosol deposition, wool, hair) and meteorological conditions

IP : infected premises
 DC: dangerous contacts

References/expert advice

Information on wildlife and meteorological conditions has been provided with a previous assessment.

Survival of the virus on pasture depends on temperature. In summer months reported survival is 2-5 days while at 1.3°C reported survival is 30 days. On wool and cow hair

reported survival times are 14 days and 4-6 weeks respectively. For survival in milk see Section 3.1.

Conclusion

The factors that have the greatest influence on the probability of exposure are the level of contact with livestock and areas where livestock have been and the survival of the virus in the environment. The level of contact can be influenced by the behaviour of the persons or accompanying animals. If access to areas where livestock are present and the movement of livestock onto footpaths are minimised, the probability will be reduced.

4. Probability that persons or accompanying animals in the locality of the footpath are contaminated

Any contaminated person or accompanying animal in the locality of the footpath may have been contaminated before arrival at the footpath, while in the locality of the footpath or both. Contamination while in the locality may have occurred while on the footpath or while on other land. The probability of a person or accompanying animal being contaminated is then a combination of the probabilities derived in steps 1, 2 and 3 above.

5. Probability that domestic livestock are infected as a result of footpaths remaining open to the public

5.1. Probability of release of contamination from persons or accompanying animals and probable amount released

Factors which are likely to affect this probability and amount	Comments and risk estimate if/where appropriate
Behaviour of persons or accompanying animals	Increase with contact with the environment, particularly foliage, and level of movement
Number of contaminated persons or accompanying animals	Increase with increasing numbers
Site of contamination	Probability will be highest if feet are contaminated
Level of contamination on persons/animals	Both will increase with increasing level of contamination; level will depend on behaviour, time since, site of and initial level of contamination
Meteorological conditions	Both increase with wind, relative humidity and presence of inversion
Disinfection	Disinfection after leaving locality of footpath will decrease probability and amount
Disposal of objects including animal food products	Inappropriate disposal will increase probability

References/expert advice

Information on wildlife and meteorological conditions has been provided with a previous assessment.

Conclusion

The behaviour of persons or animals in the locality of the footpath has the greatest influence on the probability and amount of virus released. In particular, extensive contact with the environment will increase the probability and should thus be avoided. The number of contaminated persons and the level of contamination will also increase the probability.

5.2. Probability of exposure to infection (given release of contamination)

Factors which are likely to affect this probability	Comments and risk estimate if/where appropriate
Proximity to susceptible livestock	Probability will increase with proximity to susceptible livestock; highest probability will be if animals are found on the footpath, either after escape or during movement
Perimeter security for livestock	Perimeter security should prevent escaped livestock; increasing probability of escape will increase probability of exposure
Movements after leaving locality of footpath	Increases if person or animals come in close proximity to susceptible animals (depends on occupation and participation in sports); increasing time between leaving footpath and coming close to such animals will decrease probability
Behaviour of persons or accompanying animals	Behaviour which leads to contact with susceptible animals will increase probability
Presence of wildlife	Presence may increase distance of virus travel and thus probability
Site of contamination	Site of contamination, e.g. footwear, will affect probability of survival and hence subsequent exposure
Environmental conditions	Soil type, pH and origin of virus (excrement) will affect probability
Meteorological conditions	Meteorological conditions will affect survival; probability will thus increase with wind, relative humidity and presence of inversion

References/expert advice

Survival on footwear is reported as 15 weeks. For survival in the environment see Section 3.2.

Conclusion

Whether or not susceptible animals are exposed to the virus is most dependent on the proximity of the footpath to those animals. In addition, the behaviour of persons and accompanying animals can have an influence. The nearer the footpath and the greater the level of contact, the higher the probability of exposure. Further, movements after leaving the footpath will affect the probability. If contact with livestock animals is made, the probability will increase.

5.3. Probability of infection (given exposure)

The same factors affect the probability of infection irrespective of whether infection occurs in the locality of the footpath or at another site.

Factors which are likely to affect this probability	Comments and risk estimate if/where appropriate
Dose of virus	Increases with an increased dose; dose received depends on level of contamination; likely to be low as contamination of fomites and lowest if exposure at another site
Route of infection	Probability of exceeding infective dose highest with direct inoculation, followed by aerosols; oral route requires highest dose
Virulence factors	Strain of virus will affect probability
Host factors	Probability will vary with, e.g., immune status, age, general health, nutrition, gestation stage (females), season

References/expert advice

Information on infective dose, routes of infection, virulence factors and host factors has been provided with a previous assessment.

Conclusion

The probability of infection depends on the infective dose being exceeded which depends on the amount of virus present and the route of infection. In this situation, the dose received is likely to be low as it relates to fomite contamination. The route of infection is likely to be direct contact, especially if persons or accompanying animals come into contact with susceptible animals.



Impact sur l'environnement de l'épizootie de fièvre aphteuse en Grande-Bretagne en 2001 : l'analyse des risques pour la gestion des risques à la campagne

K.C. Taylor

Résumé

En Grande-Bretagne, les restrictions imposées en 2001 pendant plus de dix mois pour maîtriser et éradiquer la fièvre aphteuse ont eu un effet néfaste sur le tourisme et les entreprises établies en zone rurale. L'évaluation des risques peut s'avérer un instrument très précieux pour garantir qu'une action donnée soit proportionnelle au risque et que les activités rurales reprennent leur cours normal dès que la situation l'autorise, sans pour autant compromettre l'objectif de maîtrise et d'éradication de la maladie.

Un Service d'évaluation des risques a été instauré, dès les premiers signes de l'épizootie, dans le but d'apprécier les risques inhérents à certaines activités, d'élaborer des modes de gestion de ces risques et de formuler des recommandations sur lesquelles les décideurs politiques pourraient s'appuyer lors du choix des actions à entreprendre. La publication des résultats des évaluations effectuées par le service a permis au public d'examiner et de critiquer les arguments scientifiques qui ont étayé les changements de politiques et de procédures.

L'auteur dresse l'inventaire des activités qui ont été soumises à des évaluations de risque zoonositaire et explique comment la mise en œuvre du processus a permis d'autoriser ou non l'accès du public à la campagne. Ce processus a impliqué des changements de politiques, qui se sont traduits par la réouverture, après une période de neuf mois, de plus de 96 % des sentiers et pistes cavalières, sans pour autant provoquer l'apparition de nouveaux foyers de fièvre aphteuse. L'auteur présente également un exemple d'évaluation complète des risques.

Mots-clés

Accès au public – Activités rurales – Évaluation des risques – Fièvre aphteuse – Grande-Bretagne – Prophylaxie – Royaume-Uni.



Consecuencias ambientales de la epidemia de fiebre aftosa en 2001 en Gran Bretaña: utilización del análisis de riesgos para gestionar riesgos en las zonas rurales

K.C. Taylor

Resumen

Las restricciones impuestas en Gran Bretaña en 2001, durante más de diez meses, para controlar y erradicar la fiebre aftosa resultaron perjudiciales para el turismo y las empresas rurales. La evaluación de riesgos puede ser útil para lograr que las medidas adoptadas guarden proporción con el riesgo existente y que la actividad en zonas rurales retome su curso cuanto antes sin que peligre el objetivo de controlar y erradicar la enfermedad.

Al declararse la epidemia se instituyó una unidad de evaluación de riesgos, encargada de valorar los riesgos ligados a actividades concretas, encontrar formas de gestionarlos y formular recomendaciones de las que pudieran servirse las autoridades para tomar decisiones sobre las medidas que convenía adoptar. Las evaluaciones elaboradas por esa unidad fueron publicadas, lo que dio a la sociedad la ocasión de conocer y criticar los criterios científicos en que se basaron los subsiguientes cambios de políticas y métodos de trabajo.

Tras enumerar las actividades sujetas a evaluación de riesgos zoonosarios, el autor explica cómo se utilizó el proceso para estudiar y después modificar los criterios de acceso público a las zonas rurales, lo que llevó a reabrir más del 96% de los senderos y caminos de herradura en un período de nueve meses, sin que ello indujera nuevos brotes de fiebre aftosa. El autor también presenta un ejemplo de evaluación de riesgos completa.

Palabras clave

Acceso público – Actividades en zonas rurales – Evaluación de riesgos – Fiebre aftosa – Gran Bretaña – Profilaxis – Reino Unido.



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