Department for Environment, Food and Rural Affairs

TB Science Workshop report

The Royal Society 25th April 2013

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Introduction

Bovine TB (bTB) is one of the most pressing animal health problems currently facing our livestock industry. Our existing tools and their application are not reversing the overall high prevalence of bTB in cattle herds in the West of England and we're seeing a geographical spread of infection, both within and at the edge of the endemic area. This is leading to significant costs both to government and the industry. It is vital that we have, and make use of, the best available evidence to control and eventually achieve officially bTB-free (OTF) status for the whole of England and are proactive in innovating to tackle the challenges we face.

That is why on 25th April I convened a meeting of around 50 scientists across a range of disciplines, active in the field of bTB and wildlife research, at the Royal Society in London. I wanted to share with them Defra's current and future research strategy for bTB; listen to, collate and synthesise the views of the natural and social scientific community about how we achieve OTF status; and engage with them about how scientific evidence is assimilated alongside other forms of evidence in the policy making process and how we can work together to find new and innovative solutions.

This report is a summary of that meeting which captures the main messages coming out of the discussions and sets out how we are going to build upon the momentum gained.

Professor Ian Boyd

Outline of the day

- Professor Ian Boyd: *The current disease state and consequence of no further action*
- Nigel Gibbens: *TB Epidemiology and England's eradication strategy*
- Professor Glyn Hewinson: *Challenges in the research, development and deployment of new tools to tackle bovine TB*
- Professor Charles Godfray: *Scientific evidence statements*
- Panel Q&A session
- Break-out groups: *Multi-criteria analysis and facilitated discussion of the evidence base*
- Feedback and round-up

Presentations and Q&A

Ian Boyd

Professor Ian Boyd, Defra's Chief Scientific Advisor, opened the day by providing an account of the current disease status and reasonable worst case scenario if no further action is taken. AHVLA epidemiology modelling suggests that continuing with the current set of controls will lead to an annual increase in confirmed herd breakdowns of 3% per annum. The £1 billion estimated spend on controlling TB in England over the next 10 years will only be slowing down the tide of infection, not stopping it.

Professor Boyd described the disease control strategy as consisting of 4 pillars of activity all of which are being pursued with equal vigour: surveillance in cattle herds; vaccination; biosecurity; and addressing the reservoir of infection in badgers. He emphasised that badger culling is only one measure and that the purpose of the day was to talk about the range of controls and evidence that supports their use.

He concluded his talk by describing a conceptual model of evidence informed policy decisions. This model demonstrates how scientific evidence is considered alongside that relating to other factors such as social issues, economics, practicality and politics when making policy decisions. The relative amount of each will vary through time and between circumstances and it is this variation that results in different solutions in England, Wales, Northern Ireland and the Republic of Ireland, even though they are all based upon the same scientific evidence base. The role of the scientist is to ensure that scientific evidence in this model is both robust and fit for purpose to help inform policy decisions.

Nigel Gibbens

Nigel Gibbens, Defra Chief Veterinary Officer, provided an overview of bTB epidemiology and England's eradication strategy. Nigel described the historical situation where the incidence and geographic distribution of bTB in GB was greatly reduced following the introduction of a mandatory bTB test and slaughter programme for cattle herds in the 1950s, reaching a low in the 1970s and early 80s before the incidence began to increase. Currently, whilst the existing controls are having an impact on the disease by removing infected cattle, protecting the low risk areas and slowing down the doubling rate of breakdowns, the epidemic is worsening particularly in the endemic areas in the West and South West of England. The history of badger control was discussed along with the scientific evidence from the Randomised Badger Culling Trial, which conclusively demonstrated that transmission from badgers makes a significant contribution to the incidence of TB breakdowns in cattle.

The different routes of transmission were discussed including the potential for transmission from cattle to humans and the controls put in place to prevent this. Cattle-to-cattle transmission is controlled using surveillance (routine tuberculin skin-testing of herds at

regular intervals, mandatory pre-movement testing and surveillance for lesions at the slaughterhouse) and bTB herd breakdown management (including prompt removal of reactors, movement restrictions and targeted testing of cattle herds with epidemiological links to the index case). Badger-to-cattle transmission can be reduced through badger culling, which if done on a sufficient scale, in a widespread, coordinated and efficient way, and over a sustained period of time, may reduce the incidence of bTB in cattle in high incidence areas. While there is no direct evidence on their impact on bTB incidence in cattle, transmission could also be reduced by badger vaccination and implementation of biosecurity measures aimed at keeping cattle and badgers apart.

Defra will be consulting on a new bTB eradication strategy in summer 2013, which will provide a tailored package of measures according to the different epidemiology of the disease in defined high risk, low risk and edge areas of England. . In the high risk area, cases are often caused by residual infection left within a herd at the end of a breakdown, cattle movements or by transmission from badgers. In the low risk area, the vast majority of TB breakdowns are caused by the inward movement of undetected infected cattle from high risk areas. It is not currently known exactly what drives the expansion of the high risk area in the edge area but Defra is funding research to identify risk factors.

The Defra bTB research and development programme also funds research both to further our understanding of the epidemiology of the disease and to develop new tools which can be used as part of a package of control measures. Current research priorities include development of a licensable oral badger vaccine, development of a BCG cattle vaccine and an accompanying diagnostic test and alternative methods of badger control.

Glyn Hewinson

Professor Glyn Hewinson, Chief Scientist at the Animal Health & Veterinary Laboratories Agency (AHVLA) gave a presentation discussing the technical and operational challenges encountered during the research, development and field deployment of new tools to tackle bovine TB in cattle and badgers. Professor Hewinson spoke about the different tests available for the detection of bTB infection in cattle, the difficulties in accurately measuring the performance of the tests, and the practical difficulties associated with testing cattle under field conditions. He also spoke about how tools like genotyping of bacterial isolates can increase our understanding of the epidemiology of the disease. The presentation also discussed some of the extensive research that underpins the development of the cattle BCG vaccine and associated differential diagnostic test. Many hurdles will need to be overcome to gain international acceptance for use of the vaccine and accompanying test, and there are considerable challenges to the development of improved vaccines, such as those that do not sensitise cattle to the skin-test.

There are difficulties associated with the diagnosis of bTB infection in badgers in the field, and work is ongoing to develop ways of taking samples from badgers without the need for anaesthesia and to develop improved tests. An injectable BCG vaccine is licensed for use in badgers but the need to trap the animals to administer the vaccine makes this

expensive to deploy in the field. Oral badger vaccines offer the potential for a more practical way to vaccinate wild badgers, but this research and development work is dependent on scientific breakthroughs, including the development of a suitable oral bait.

Q&A session

The Q&A sessions that followed the presentations covered a wide range of issues related to the evidence base and became more of a group discussion as answers came from both speakers and participants.

During the discussion, participants questioned the evidence base for wildlife controls, particularly around what we know about the disease in wildlife (including transmission routes and the possible role of species other than the badger), the impact that various controls can have on the disease and the interplay between science and practicality. While science plays an important role in advising decision makers on the level of uncertainty and likely impact of risks around policy options, scientists also need to be cautious about confusing well-intentioned scientific advice with political messages. It was also queried whether it would be possible to carry out an assessment of the role that previous badger removal operations have had on the control of the disease, including their political and social role in addition to their impact on disease.

There was some discussion around the extent to which we can extrapolate from the experience of other countries. Whilst different countries will face their own distinct challenges, we can learn from their approach and seek to adapt this to the UK situation. The current surveillance programme looks for changes at the population level and it would be advantageous to sharpen it to allow a more focused look at disease epidemiology, including any changes, characteristics and risk factors at a local level. It was however acknowledged that the potential to do this on a wide-scale basis was limited by available resources.

Points were raised about the need for more than just technical solutions with a shift towards a more multidisciplinary approach, which should be better reflected by the breadth of evidence commissioned by the R&D programme currently dominated by the natural sciences. Consideration should also be given to the governance model for bTB control in this country, potentially learning from New Zealand, so that farmers take more ownership of the eradication programme. We need to understand the attitudes of farmers and how these may influence the effectiveness of controls. It was pointed out that our evidence base is increasingly more multidisciplinary as we build up our understanding of how market incentives and social attitudes influence disease control.

Afternoon session: multi-criteria analysis (MCA) workshop and discussion

Participants were divided into six groups for the afternoon session and tasked with discussing the evidence base for different TB risk areas of England. The discussion was facilitated by a MCA designed by Professor Rob Fraser from the University of Kent.

The facilitated table discussions covered many aspects of the evidence base for how we're tackling bTB. They provided constructive challenge for how we develop the bTB Eradication Strategy as well as suggestions for how we can further develop the evidence base and innovate to tackle the disease.

Highlights from the discussions include:

- The impact of on-farm biosecurity measures on herd breakdowns is an obvious and important evidence gap. Demonstrating the effectiveness of these measures will be crucial to encouraging their uptake.
- We need a greater understanding of what is driving the spread of the disease and the level of disease in wildlife, particularly at the edge of the high risk area.
- We do not understand why so many herds in the high risk area are able to stay bTB free. Can we learn from their characteristics?
- Can we develop a more coordinated approach to surveillance and control and improve on both our diagnostic tools and means of data collection?
- We should make use of economic incentives to encourage better trading patterns, discouraging risky practices. This could be important for maintaining disease freedom in large parts of the country. There may be opportunities to work with retailers through assurance schemes.
- It is important to recognise that farmer and veterinary attitudes and behaviours affecting compliance and engagement with control efforts are likely to be important reasons for control failures.
- Given the urgency of the problem and the current knowledge available, there should be a move to start local eradication programmes in which farmers are given a key role. Demonstration programmes, conducted on relatively small scales, are invaluable in both highlighting the challenges to eradication (and hence help setting a research agenda) and gathering political and social momentum.
- Local eradication groups could play an important role in tackling disease but they will need support and facilitation.
- Demonstration programmes, like Thornbury, can be useful for learning what is required to eradicate and how we are going to achieve it.

- Farming and the rural environment is very heterogeneous and a one-size fits all approach won't work. Even within risk areas there are huge variations that require bottom-up, tailored analysis.
- What would the consequences of doing nothing be and is there a role for government if the human health risks can be managed?
- Avoid looking at bTB in isolation, instead seeking lessons learnt from the extensive amount of work carried out on cattle herd health planning.
- Do not forget the large amount of previous work carried out on both bio-security and farmer behaviour: avoid re-inventing the wheel when there is much to be learnt from the past.
- Understanding how infection is transmitted between wildlife and cattle is a particularly difficult research question to address and it needs to be recognised that investment in further research may well fail to generate definitive answers (as opposed to possible correlates).
- We are aware of the risk of transmission by cattle movement, there are precise records on cattle movements and there are modelling data that give estimates of risks of transmission by animal movement. We need to make better use of this and increase our understanding of the economic and social factors at play. The encouragement of farmers and vets to take the initiative on this and other measures would be a positive step.

Multi Criteria Analysis is an example of an horizon-scanning methodology. In general terms, horizon-scanning methodologies provide a structured framework for integrating information/evidence with objectives/constraints to develop a strategy or strategies for prospective decision-making which is in an organisation's best interests. The particular strength of MCA is its flexibility. This flexibility applies both to its structure and its operation.

First, in the case of structuring the MCA for the TB Science Workshop, although the criteria chosen to evaluate the impacts of policy actions against were the standard broad classes of "Economic", "Social" and "Environmental", it was recognised that in the case of "Economic" impacts these were almost entirely on farmers, while in the case of "Social" impacts, these could be both on farmers and the wider community, and in the case of "Environmental" impacts, these were negligible and so could be omitted to simplify the evaluation task. In addition, the geographical scope of the evaluation was differentially structured among the groups of participants to enable separate consideration of the high risk, edge and low risk regions, while the use of multiple groups to look at the different regions enabled the set of relevant policy actions to be divided between groups to keep the evaluation task of manageable size. Finally, the separate consideration of "current" and "future" policy actions provided participants with the opportunity both to evaluate

Defra's existing approach, and to suggest policy innovations.

Second, in the case of the operation of the MCA for this Workshop, its size and complexity (over 50 participants, divided into 6 groups, each dealing with a different task) meant that uniformity of progress through the tasks among the groups was virtually impossible, despite all groups facing the same time constraint. However, the flexibility of operating the MCA methodology within the various groups enabled this lack of uniformity to be absorbed into the overall task, and still allow a valuable plenary feedback session to take place at the end of the Workshop. Nevertheless, the successful use of this flexibility, particularly in the context of a large and complex application, requires those operating the MCA to continually monitor and adjust its specific format – which can be a challenging activity in real time!

In summary, MCA is a powerful horizon-scanning methodology because of its adaptability to a wide range of situations. But its successful application depends on both skilful development and operation of the specific format of its use.

Professor Rob Fraser

Key messages

Each group was invited to share 1 key message to Defra and were encouraged to think about the role of innovation (see annex A). The strong messages coming back highlighted the role of biosecurity in limiting the spread of infection between animals, whether cattle or wildlife. This is an area where innovation will be vital. Key to tackling this disease will be gaining an understanding of the differences between farms and their experiences of the disease; what can we learn from those farms that have successfully stayed free from disease and how do we replicate this elsewhere? To understand and learn from this our approach and evidence needs to be more tailored, bottom-up and multidisciplinary.

Summary and final Q&A

Professor Ian Boyd concluded the day's events and considered there may be 5 themes for developing the evidence:

1. Epidemiology
2. Modelling
3. Behaviour change
4. Technology
5. Surveillance

Rather than separate these themes according to discipline and expertise, the overwhelming suggestion was that a multidisciplinary systems-based approach needs to be taken to developing a strategic overview of the evidence base.

Next steps

Going forward we want to build on the momentum of the workshop in bringing together the evidence community. We will be inviting scientists from a range of backgrounds to establish a new evidence advisory group to provide independent, multidisciplinary, strategic advice to our bTB evidence portfolio. This group will complement our existing independent advice by giving a more strategic, holistic view of the evidence. In addition, on the advice of participants we intend to hold a further meeting with key Non-Government Organisations with an interest in bTB to discuss and seek to gain a mutual understanding of both the extent and limitations of the scientific evidence base on bTB.

Annex A: Key messages by break-out group

Group 1: We need more hard evidence from observational epidemiology and field intervention studies to support the adoption of effective and practical farm biosecurity practices which could reduce the risk of cattle infection from badgers.

Group 2: We need to strengthen the evidence base that would support the development of ‘top 5’ pieces of bio-security advice and investigate options for regulations and/or incentives to promote the adoption of such practices.

Group 3: We need a demonstration project of the full range of tools and the impact they make to the disease homing in on different farms’ experience of disease – those that are free, those that have sporadic breakdowns and those that have prolonged or recurrent breakdowns. Facilitate local ownership and leadership to understand what is happening at the farm level and intervene as appropriate.

Group 4: We need to question the role of government in controlling a disease which is largely not a zoonotic (public health) risk due to pasteurisation. Farmers in the high and low risk areas can manage the risks of bTB and leave government resources and compensation to target the edge where farmers are facing increased burden while benefits are felt more widely.

Group 5: We need to adopt a more strategic, integrated and targeted approach to engagement with farmers, moving away from a ‘one-size fits all’ approach and current scatter-gun dissemination of advice packages offered by numerous different groups.

Group 6: We need a better understanding of the societal and behavioural aspects of bTB – why do people do what they do? We need a bottom-up approach that reflects the variety of motivators. Use of LRA, Edge and HRA is a good step in the right direction away from ‘one-size fits all’ to a finer grain of analysis.

This document/publication is also available on our website at:

https://www.gov.uk/government/policies/reducing-bovine-tuberculosis

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