

# The Bovine Tuberculosis Eradication Programme in Northern Ireland

## *Proposals from the Tuberculosis Strategic Partnership Group (TBSPG)*

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Scientific peer review

*Additional comments*

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09 November 2016

## Eradication timeline

*A timeline to eradication is presented in supporting material accompanying the latest revision of the TBSPG document (28 October 2016).*

1. Drawing on international experience, there has been very limited success in developing targets that realistically reflect programme 'checkpoints' into the future. In large part, this reflects the complexity of infection in a multi-host system, including the multiple (often interacting) factors (some unknown, some poorly quantified) that influence the spread and persistence of *M. bovis*. In other words, future predictions need to be interpreted with considerable care (*final report [paragraph 15]*). These concerns are acknowledged in the supporting material, which notes that '*projections of future bTB levels are fraught with uncertainty because of the complex and multifactorial nature of the disease*'.
2. Very simple methods have been used to project the timeline to eradication. These methods are underpinned by assumptions that are mainly drawn from first principles of disease control and eradication plus additional information from Ireland during 2000-2015. There is a high level of uncertainty associated with these projections, as reflected in the outputs from the sensitivity analyses. Although a timeline to eradication of 37 years is projected, this could be substantially increased or decreased with changes to key assumptions.
3. The timeline to eradication is a first step in seeking to project future progress towards bTB eradication in Northern Ireland. The proposed timeline may be useful, but must be interpreted with considerable caution given the high level of associated uncertainty.
4. As outlined previously (*final report [paragraphs 17-25]*), it is critical that the national programme is underpinned by robust and ongoing scientific support. This support should provide policy-makers with insights into programme impact on each of the key contributing biological processes that constrain eradication, such as badger-to-badger transmission, badger-to-cattle transmission, cattle-to-cattle transmission etc. There are rapid advances in scientific methodology (including methods mentioned in *final report [paragraph 15]*) that should assist Northern Ireland –on an ongoing basis – to critically evaluating progress towards eradication.

## Wildlife and vaccination

### TVR in the buffer zone

*In the latest revision of the TBSPG document (28 October 2016), it is proposed that vaccination in the buffer zone will be administered using TVR principles.*

5. Currently, there is limited information about the effectiveness of TVR in badgers. The TVR concept was considered in detail at the International Vaccination Symposium, held in Belfast in May 2012 (*final report, paragraph 27*), and potential impacts of TVR on infection prevalence in badgers and cattle have recently been modeled (Smith et al., 2013). Further, the current TVR study (*final report [paragraph 29]*) should – in time – fill some knowledge gaps.
6. There is no evidence of either a beneficial or detrimental effect of BCG in infected badgers (Chambers et al., 2014) (*final report [paragraph 111]*). Consequently, badger vaccination alone may not be sufficient to limit transmission (at least in high prevalence badger populations), initially between badgers, and subsequently to cattle, given the current force of infection in badger populations (*final report [paragraph 113]*).
7. TVR should minimise these concerns through the selective removal of infected (and potentially infectious) badgers, thereby reducing infection prevalence (and the ongoing force of infection) in the residual population during the vaccination period. Nonetheless several factors could reduce the effectiveness of this strategy, including:
  - a. the use of (pen-side) diagnostic tests with imperfect test sensitivity (in these circumstances, infection prevalence will be reduced more slowly than if a test of perfect sensitivity were used), and
  - b. the presence of a ‘perturbation effect’ following the removal of test-positive badgers, leading to social perturbation and an increase in bTB prevalence in both badgers and cattle (*final report [paragraph 118]*).
8. It is currently not possible to quantify the likely relative differences between TVR and vaccination alone, in terms of impact on infection prevalence in badgers and cattle within these buffer zones in Northern Ireland. It is critical that research is

conducted, as part of the badger intervention programme, to clarify whether the perturbation effect occurs following badger removal (*final report [paragraph 121]*), including the limited, highly focused removal that will occur during TVR in the buffer areas.

#### Method(s) of capture

*In the latest revision of the TBSPG document (28 October 2016), it is proposed that badger capture, for removal (core zone) or TVR (buffer zone), could be conducted using either cages or stopped restraints.*

9. In the interventional areas, capture methods need to adequately address potential concerns with respect both to badger welfare and capture efficiency. Considerable data are now available concerning the welfare of badgers captured in either cages (Woodroffe et al., 2005) or stopped restraints (Murphy et al. 2009; Byrne et al., 2015).
10. It is reasonable, as reflected in the TBSPG document, that both capture method could be employed, after giving detailed consideration to both badger welfare and capture efficiency.

#### Intensity and duration of intervention

*In the latest revision of the TBSPG document (28 October 2016), further detail is provided about badger removal within the core zone of the badger intervention areas.*

11. In the latest TBSPG document, it is proposed that badger removal in the core zones will be conducted for 4 years, aiming for an annual removal rate of at least 50-70%. These figures, as proposed in the TBSPG document, are extrapolated from earlier badger removal studies in Ireland (east Offaly project, four area project) and GB (Thornbury removal project, Random Badger Culling Trial [RBCT]). These studies were conducted either to clarify the role of badgers in the epidemiology of bTB in cattle (for example, the four area project, Griffin et al., 2005) and/or compare different culling strategies on bTB incidence in cattle (RBCT, Donnelly et al., 2003).

12. In the core zone of the badger interventional areas, the purpose of badger removal is somewhat different to that of these earlier studies. Here, badger removal is considered a prerequisite of badger vaccination in areas of high infection prevalence. Therefore, removal is being conducted to reduce infection pressure, both through the direct removal of infected badgers and the repopulation from the buffer to the core zone with non-infected, vaccinated badgers.
13. Currently, we do not have a good understanding of all factors critical to the success of a badger vaccination programme. In areas of high bTB risk, there is general agreement that badger removal will need to precede mass vaccination, specifically to reduce the prevalence of *M. bovis* infection in the re-emergent badger population (*final report [paragraphs 110-117]*). However, we do not currently know the intensity and duration of badger removal required, nor whether this is likely to vary in areas of differing (starting) infection prevalence, prior to the implementation of an effective vaccination programme. In the earlier, above-mentioned studies, the reductions in infection prevalence are likely the best that could reasonably be achieved during any programme of badger removal.
14. It is reasonable to extrapolate, with care, from these earlier studies in terms of the intensity and duration of badger removal mass vaccination.

#### Period of follow-up vaccination

*In the latest revision of the TBSPG document (28 October 2016), it is proposed that follow-up vaccination in the core zones will be conducted for a minimum of 3 years, but subject to ongoing review, immediately following the period of intervention.*

15. There is an increased understanding of the use of BCG vaccination in badgers. However, there remain important gaps in knowledge.
16. In Ireland, badger vaccination is being investigated as a tool to assist with the control and eradication of *M. bovis* in cattle. To this end, vaccination will be used to limit the transmission of *M. bovis* between badgers, and from badgers to cattle (Aznar et al., 2011). Based on current knowledge, it is likely that vaccination will be required for many years, if eradication is to be achieved. Scientific results from the Kilkenny badger vaccine trial will shortly become available, contributing to

knowledge of factors critical to success in a mass badger vaccination programme, including vaccine efficacy, coverage and duration.

17. If eradication is to be achieved, the national programme may need to consider inclusion of a long-term strategy of badger vaccination throughout Northern Ireland, conducted over an extended period with a high level of vaccine coverage.

## References

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