



Animal &
Plant Health
Agency

Oral badger vaccination: an overview

Professor Mark Chambers

Introduction



- *M. bovis* first detected in a badger in GB in 1971
- *M. bovis* is present in badgers across large parts of Britain and Ireland and can be source of infection to cattle
- Culling badgers for disease control can have complex epidemiological outcomes, including both positive and negative impacts on bovine TB incidence in cattle
- BCG vaccination is a complementary / alternative strategy in a package of control measures

Badger vaccination



- Goal of vaccination is to reduce pressure of infection in badgers to break transmission to cattle
- Vaccine doesn't need to protect badgers completely to be effective
- Injectable BadgerBCG licensed in 2010 after 10 years of R&D
- Vaccination encouraged in 'edge area' to protect badgers from incursion from 'high risk area'

Oral badger vaccination



- Oral vaccination has potential to be cheaper and easier to deploy
- Can be very effective
 - e.g. rabies control in Europe and N. America
 - significant differences between rabies and TB so only a limited amount can be applied
- As well as us, currently being pursued in New Zealand (possums), Spain (wild boar), and Republic of Ireland (badgers)
 - we are working with them all

Oral BCG can work

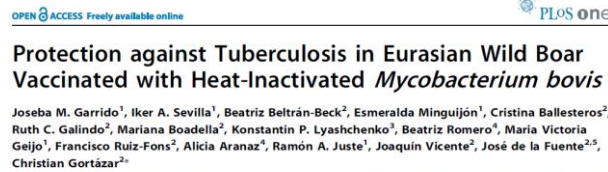
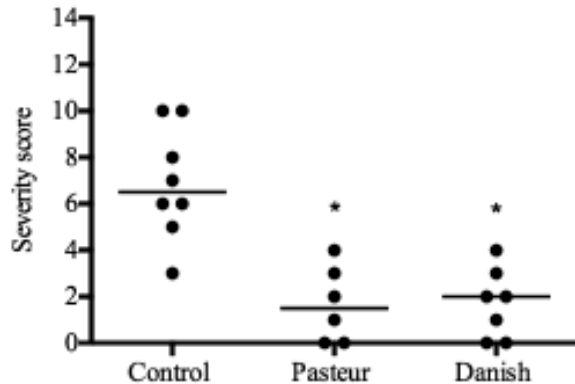


Oral vaccination of badgers (*Meles meles*) against tuberculosis: Comparison of the protection generated by BCG vaccine strains Pasteur and Danish

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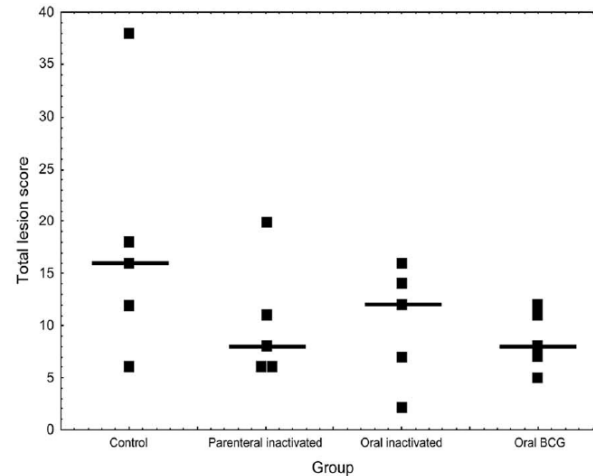
- Captive badgers
- Used live BCG in NZ lipid
- Given to back of throat
- Reduced disease severity



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- Captive boar
- Used BCG or heat-killed *M. bovis*
- Given to back of throat
- Reduced disease severity

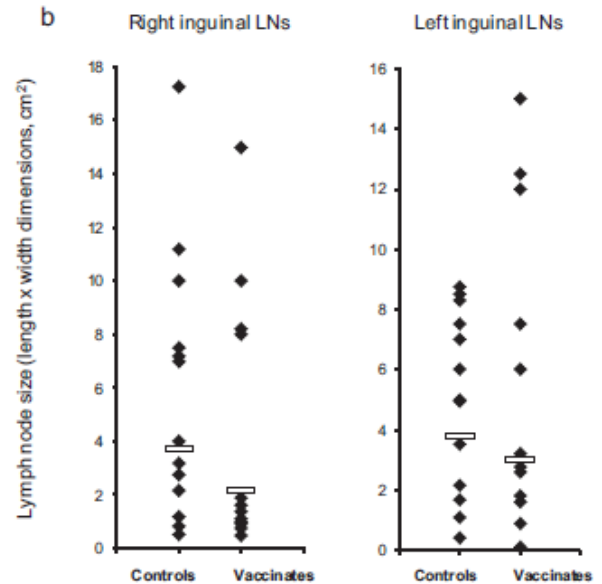


Sustained protection against tuberculosis conferred to a wildlife host by single dose oral vaccination

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- Wild possums
- Used live BCG in NZ lipid
- Given to back of throat
- Reduced disease severity even after 28 months



Oral vaccine field trial, Republic of Ireland

- Conducted in County Kilkenny from 2010-13
- BCG in NZ lipid given to anaesthetised badgers at a coverage of 0, 50, 100%
- Capture-tag-release
- Annual vaccination and serology
- At end of trial, badgers depopulated and detailed PME conducted
 - severity of infection assessed from the number, distribution and the severity of gross lesions, the number and distribution of histological lesions, and the number and distribution of culture positive tissues and the bacterial load in those tissues
- Final results expected by the end of the year
- Not a trial of a vaccine product

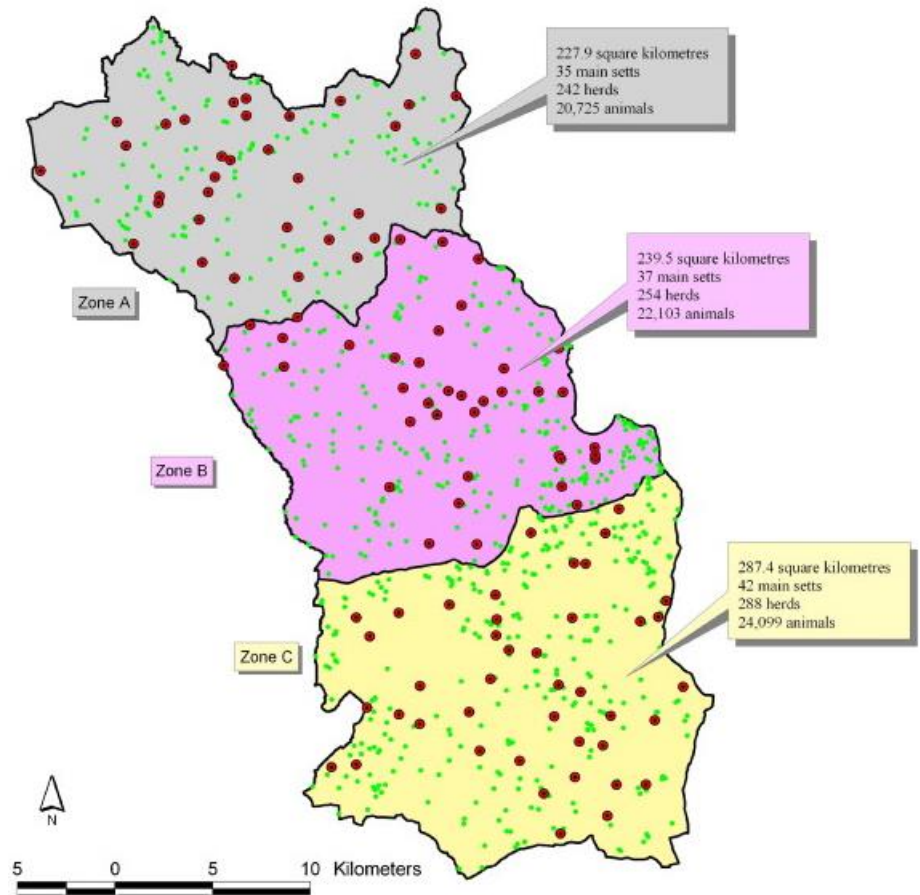


Fig. 2.

Map showing study area divided into three zones A, B and C (grey, pink and yellow, respectively) where vaccination coverage will be 100, 50 and 0%. The gradient of coverage (100–0% from north to south, or vice versa) will be allocated randomly at the start of the trial. Main badger setts are represented with red dots, and green dots represent other sett types.

Aznar I, et al. (2011). Trial design to estimate the effect of vaccination on tuberculosis incidence in badgers. *Vet Microbiol.* 151:104-11

Oral badger vaccination

– work at APHA



- Defra and Welsh Government funding R&D at APHA since 2005
- We are seeing similar results for BCG in badgers
 - importantly, using BCG presented in baits that badgers eat
- Shared experience is needed to use at least 10x times the amount of BCG orally to get same effect as injected BCG
 - increases the cost
- Protection more variable than injected
 - more studies needed to show consistent levels of protection
- Safety study conducted with high doses of BCG

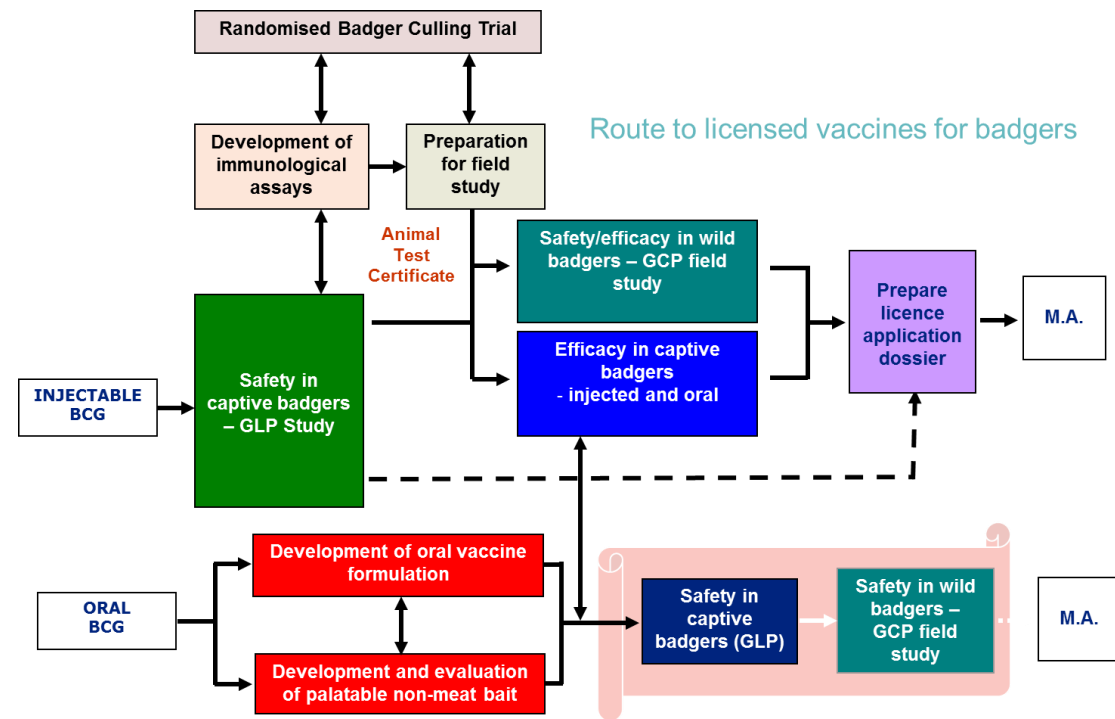
Bait and deployment



- Even the best oral vaccine needs a suitable bait
- NWMC, APHA conducting the work on bait evaluation
 - 13 Bait Preference Studies completed to measure bait disappearance and CCTV to determine preference
 - 4 Bait Deployment Studies completed with biomarkers in bait to measure uptake
- Things learnt so far:
 - Wild, naïve badgers will consume our candidate bait in packaging
 - Uptake by cubs better than adults
 - Pre-baiting will be necessary for best uptake of vaccine bait
 - Deployment down sett holes works (and reduces risk of cattle exposure)

Next steps

- Further evaluation of efficacy
- Analysis of bait deployment data & recommendation on deployment protocol
- Identify manufacturer
- VMD evaluation of safety data
- Field safety (and efficacy?) study
- Production of licensing application and submission to VMD
- Significant progress made, but considerable challenges



Thanks to...!

- Staff past and present of the APHA Badger Team and National Wildlife Management Centre
- Our collaborators
- Our funders
- You, for listening