Epidemiological effects of badger culling and vaccination

Two important facts about bovine TB

TB is a huge problem for both beef and dairy farmers
Badgers are part of the problem

Bovine TB is a very serious issue which demands an effective solution
Epidemiological effects of badger vaccination and culling

Introduction to disease dynamics
Badger culling
Badger vaccination
Susceptible and infectious hosts
susceptible  infectious
transmission
Individual Immunity

- **Immune**: not infectious, no transmission
- **Infectious**: can transmit the disease

Diagram shows the concept of individual immunity in a population.
Herd Immunity

Herd Immunity
Herd Immunity

Where do susceptibles come from?
Population structure is important
Culling
Fewer infected hosts
Fewer susceptible hosts

Less frequent contact between infected and susceptible hosts
RBCT culling reduced badger numbers… …but also altered badger ranging behaviour

Numbers of badgers dropped over time… but numbers of infected badgers fell more slowly

As culls were repeated, the proportion of infected badgers increased
Badger culling has two opposing consequences

Fewer badgers - good

Each remaining badger more infectious – bad

How does changing badger density influence TB risk to cattle?
Absolute changes in numbers of new confirmed TB breakdowns

- Inside & outside survey-only
- Inside & outside proactive

Note caveats!

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<th>Cattle TB</th>
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Vaccination
Vaccination

Removes susceptibles by making them immune

No impact on those already infected

Nevertheless, helped eradicate smallpox and rinderpest, and to control many other diseases e.g. measles, rabies, human TB
Badger vaccination

- injectable vaccine for badgers available now
- reduces individual risk of new infection by 76%
- reduces risk of unvaccinated cubs becoming infected by 79% if ≥30% of adults vaccinated in group
- leaves badger territory structure intact, which may enhance effectiveness of vaccination
- as transmission to other badgers is reduced, transmission to cattle also likely to be reduced
- wildlife sector keen to contribute to deployment

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Conclusions
Culling and vaccination function by different mechanisms but both have the potential to control wildlife disease.
Population structure has a major impact on disease transmission rates.
Culling alters badger population structure in ways which accelerate transmission, undermining benefits for TB control.
By contrast, badger population structure may enhance the efficacy of vaccination.
Badger vaccination is likely to be cheaper than culling, and is unlikely to cause harm; however its contribution to cattle TB control is not yet known.