Difference in Differences analysis evaluates the effects of the Badger Control Policy on bovine tuberculosis in England

Birch *et al.* (2024) Nature Scientific Reports

Animal & Plant Health Agency

A badger control policy (BCP) was introduced in England in 2013, which includes industry-led badger culling and other bovine tuberculosis (TB) control measures in licenced areas. By the end of 2022, 72 areas had been licenced for BCP interventions. A recent analysis by Birch *et al*. (2024)[1] estimates a 56% reduction in TB incidence rate in the fourth year of BCP interventions.

What data were used?

Data on the rate of cattle TB breakdowns (incidence rate) from the first **52 BCP** areas in the High Risk Area (HRA) and Edge Area of England that were licenced between **2013-2020**

What approach was used?

A **difference in differences** analysis was used. This is a well-established method in econometrics.

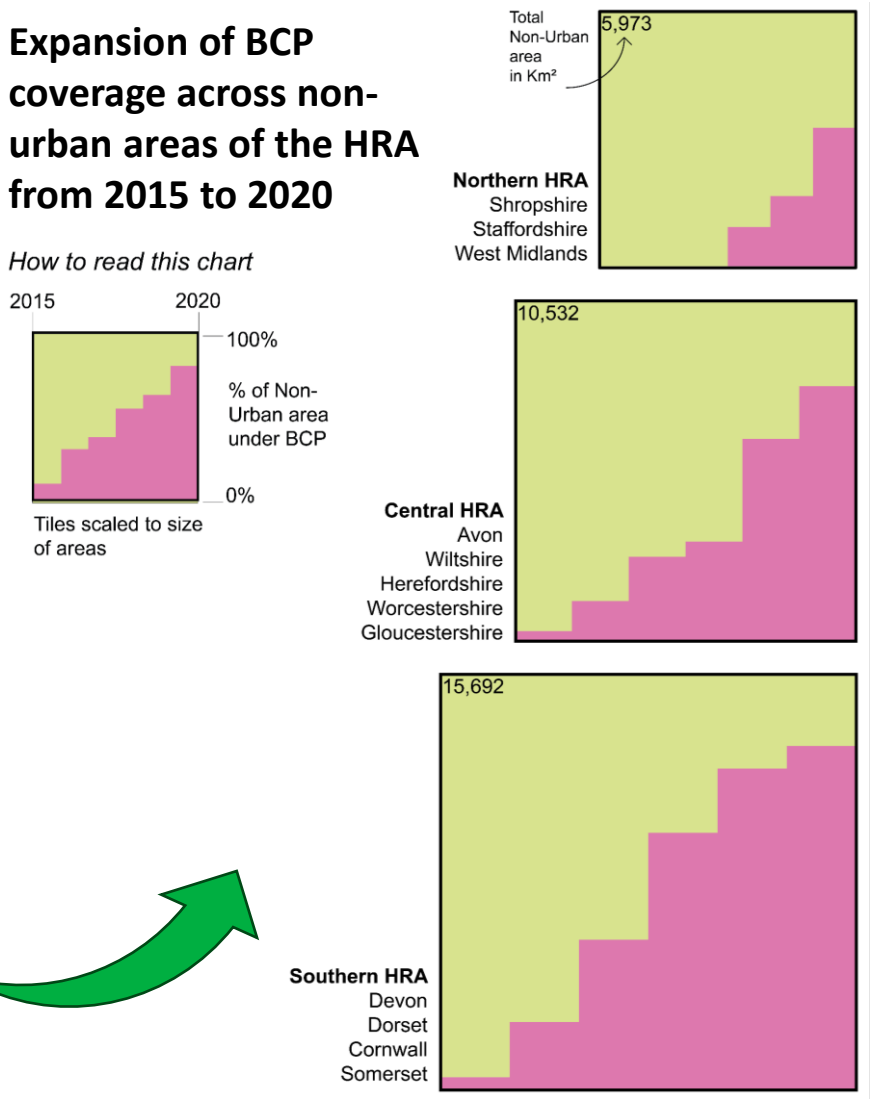
The rate of new TB breakdowns was compared within and between different BCP areas, before and after the start of BCP interventions. The approach estimates the average effect of the BCP across areas.

This is a different approach to previous analyses of BCP effects published by APHA, which compared rate of TB breakdowns in up to 3 BCP areas with areas not subject to BCP interventions[2,3]

Why was a different approach needed?

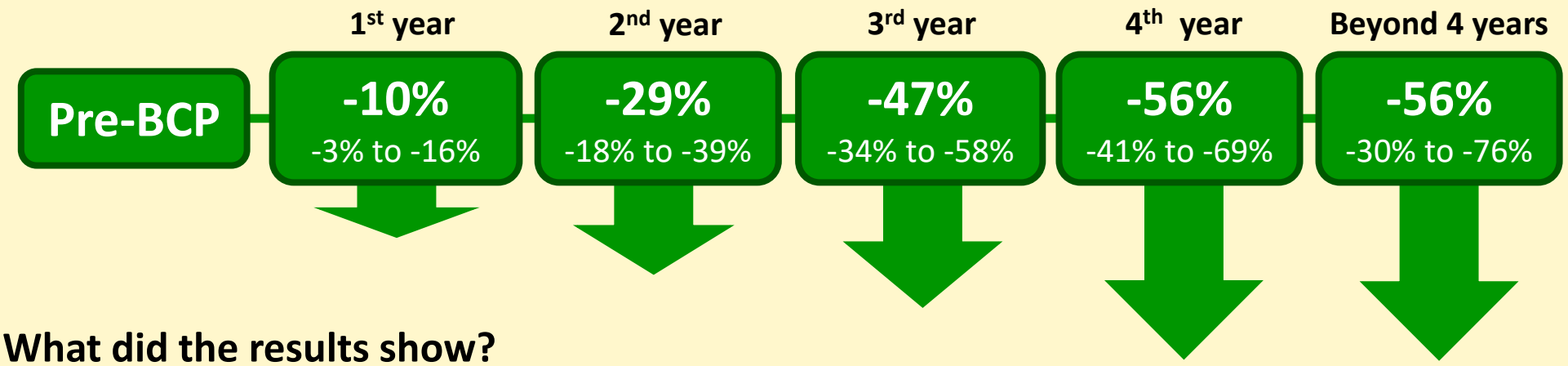
The BCP has expanded over time. By 2020, licenced BCP areas covered a large proportion of land in the HRA. There are now too few comparable non-BCP areas to continue using the previous approach.

Expansion of BCP coverage across non-urban areas of the HRA from 2015 to 2020



Estimated average cumulative reduction in OTF-W TB incidence rate by year across all BCP areas

95% confidence intervals are also shown (a measure of statistical uncertainty)



What did the results show?

The rate of new confirmed TB breakdowns (OTF-W) declined significantly over time after the start of BCP interventions.

There was relatively little effect during the first year. Incidence rate then decreased substantially in the second and third years, reaching a 56% reduction overall in the fourth year. The size of the effect did not increase significantly beyond four years.

There was also a decline in the rate of total TB breakdowns (OTF-W and OTF-S incidence rate combined), reaching a 45% reduction after four years.

How does Difference in Differences analysis work?

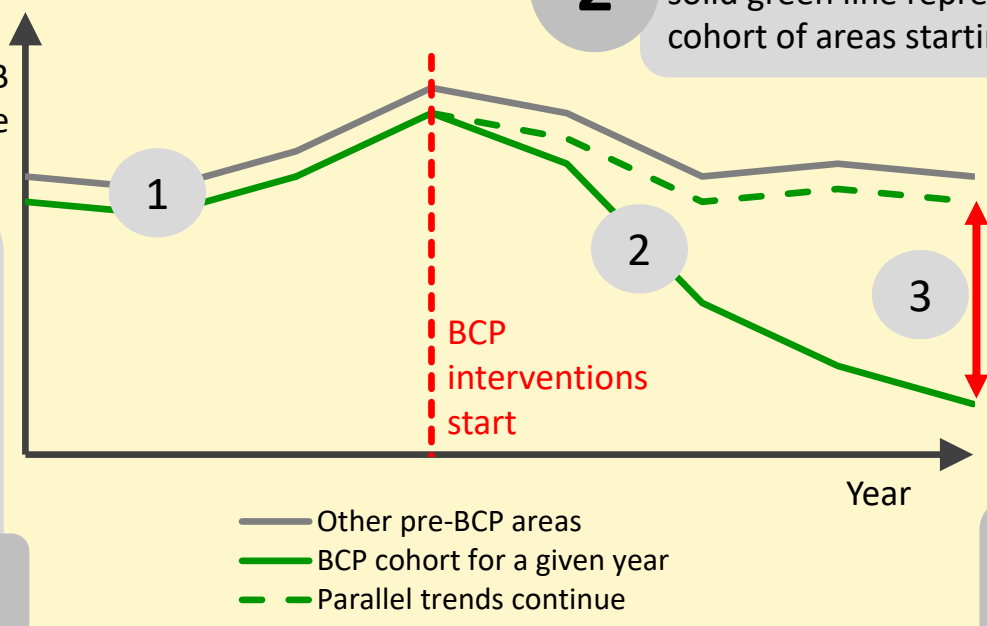
1

The analysis assumes that average trends in TB incidence rate across all areas were close to parallel before BCP interventions began

✓ This was verified by observed data

2

BCP interventions started over a series of years – the solid green line represents the average trend for a cohort of areas starting in a single year



3

The BCP effect in the cohort is estimated by the average change in TB incidence rate once BCP interventions began compared to the parallel trend

This assumes that if the BCP had no effect, the cohort trend would remain parallel to trends in other areas not yet subject to the BCP

*Note: This diagram **does not** depict the results of the analysis and is for demonstration of the analytical approach only.*

How do the results from this analysis compare to previous analyses?

Two analyses of the effects of the BCP have already been published by APHA.

As well as a different statistical method, the new analysis uses data from more BCP areas and from a longer time period.

The effects reported are consistent with the previous published results. However, the new analysis estimates the timing of the effects of BCP interventions more precisely.

The findings are also consistent with the reported effects of interventions that included badger control in situations other than the BCP. For example, the Randomised Badger Culling Trial[4] conducted in England between 1998 and 2005, and the four counties study in Ireland[5].

- **Birch *et al.* (2024)[1]** — 52 BCP areas, Up to 8 years of BCP
- **Downs *et al.* (2019)[2]** — 3 BCP areas, Up to 4 years of BCP
- **Brunton *et al.* (2017)[3]** — 2 BCP areas, 2 years of BCP

What doesn't this analysis tell us?

- The BCP comprises of badger culling alongside other TB control measures, including additional interferon gamma blood testing and provision of biosecurity advice. This analysis does not explicitly distinguish the effects of the BCP's component measures.
- It estimates the average effect of the BCP across the areas included in the analysis. It does not provide area-specific estimates of the BCP effect. The estimated effect is most influenced by the BCP areas that were licenced in earlier years.
- Its estimate of the BCP effect is imprecise beyond 4 years of BCP interventions because insufficient time has elapsed since interventions were first introduced.

Further analyses to evaluate the effect of the BCP on cattle TB incidence rate are planned. These will incorporate additional years of data from even more BCP areas. This work will seek to investigate between-area differences in BCP effects and provide more specific evidence of the effects of the BCP's component interventions.

For more information and advice on a range of TB topics visit the TB hub

Animal & Plant Health Agency

Department for Environment Food & Rural Affairs

References

1. Birch, C. P. D. *et al.* Difference in Differences analysis evaluates the effects of the Badger Control Policy on Bovine Tuberculosis in England.
2. Downs, S. H. *et al.* Assessing effects from four years of industry-led badger culling in England on the incidence of bovine tuberculosis in cattle, 2013–2017.
3. Brunton, L. A. *et al.* Assessing the effects of the first 2 years of industry-led badger culling in England on the incidence of bovine tuberculosis in cattle in 2013–2015.
4. Donnelly, C. A. *et al.* Impacts of widespread badger culling on cattle tuberculosis: concluding analyses from a large-scale field trial.
5. Griffin, J. M. *et al.* The impact of badger removal on the control of tuberculosis in cattle herds in Ireland.