POLICY BRIEF: An economic analysis of consequences of animals persistently infected with BVD virus

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1. KEY MESSAGE

BVD is endemic in Scotland and mainly spreads via persistently infected (PI) cattle, so the retention of PIs has great potential to hinder efforts to eradicate BVD from Scotland. A single PI in the a herd contributes the bulk of financial cost due to reduced milk production and increased abortions for farmers, and the additional cost of an extra PI decreases as the number of PI animals increases. The benefit of removing the last PI in a herd is higher than the benefit of removing any others. Therefore, this analysis informs and supports the Scottish Government's BVD Eradication Scheme to remove all PIs from Scottish dairy and beef herds.

2. MAJOR FINDINGS

1) The analysis suggests an increased financial cost, reduced milk production and increased abortions are associated with having an increasing number of PIs in a naïve Scottish cattle herd.
2) The financial cost (Figure 1) associated with retaining just one PI in a dairy and beef herd is £35 and £55 per cow per year, respectively. This is due to reduced milk production and increased reproductive losses (which includes increased abortion and reduced conception/delayed rebreeding in both the dairy and beef herds).
3) The financial cost for a beef herd with PIs is between 1.5 and 2 times greater per cow per year compared to a dairy herd with PIs, depending on the number of PIs within a naïve herd. This is probably because of greater contact between beef calves and cows compared to dairy calves, giving greater opportunity for PI calves to spread virus in beef herds. BVD virus free status can occur in a herd by either targeted farm management or self-clearance, i.e. once all PIs are removed from the herd or die. In this study, the estimated probability of self-clearance, at 5 years, is higher in the dairy herd (0.98) than for the beef herd (0.18), which suggests that the BVD virus has greater opportunity to transmit in a beef than a dairy herd.
4) On-farm metrics (Table 1) suggest that on average, a dairy herd loses 65 litres of milk per cow per year and a beef suckler herd experiences an increase from 0% to 6% cows aborting in the herd per year when one PI cow enters a naïve herd.

3. OBJECTIVES

This study examined the costs to farmers of having a cow persistently infected with BVD virus within a Scottish dairy herd and a beef suckler herd. This rationale was to provide evidence to inform the Scottish Government's BVD eradication scheme.

4. POLICY IMPLICATIONS

BVD is maintained on farms by the presence of PIs and the removal of these animals is a control measure to eliminate the spread of BVD. Therefore, evaluating the costs to farmers of animals PI with BVD virus is particularly important from a policy perspective, given the Scottish Government's commitment to eradicate BVD virus from Scotland.

This study supports the eradication scheme because it suggests that the removal of any number of PIs from a herd will be of benefit to farmers.
Importantly, the financial benefit, to the farmer, of *complete* removal of PIs from a herd is highlighted. Therefore not only is complete removal at the herd level in the interest of the eradication scheme, it is also beneficial to the farmer. Therefore, it is imperative that all animals identified as PI are removed from the herd because otherwise these animals contribute to increased costs and reduced yield in a herd for farmers on an ongoing basis.

5. IMPORTANT ASSUMPTIONS AND LIMITATIONS

This study used existing models to estimate farm-level costs of BVD virus and on-farm metrics (i.e. lost milk yield and increased abortions) associated with the number of PIs entering a naïve dairy and beef suckler herd.
The models predicted the average costs of BVD per cow per year for a dairy and a beef suckler herd. We assumed there are 176 dairy cows in a dairy herd and 48 beef cows in a beef herd (Scottish Government, 2017), to reflect the average size of a typical Scottish herd.
The models were based on many assumptions which represent an average farm to ease comparison of the effects of alternative PI numbers. For instance, we assumed that farms had perfect biosecurity, i.e. there was no risk of BVD virus entering the farm except via the PI animals of interest. In addition, we do not reflect the variation in farm type, yield and cost across Scottish dairy and beef suckler herd systems.
The on-farm metrics indicate a wide range of generic problems that may be exacerbated by the virus (productivity, fertility, calf health, mortality etc.). Affected cattle are at greater risk of other infections due to a weakened immune system. The uncertain nature of this phenomenon makes it difficult to estimate impacts and hence costs of BVD. In the modelling, where there was uncertainty in cost parameters, the published models were based on conservative estimates for cost within the likely range (Gunn et al., 2004).
We have confined our study to the farm where BVD virus has been acquired, and did not include a risk of cost to neighbouring farmers. There are other studies that estimate the regional and national cost of the disease.
While the results presented here have identified financial and production impacts of a PI within a herd, it is important to note that the results are based on conservative modelling assumptions for the reasons explained above. These estimates are, therefore, likely to be an underestimate of the full potential impact.

6. FIGURE AND TABLE

Figure 1. Average financial cost per dairy and beef cow per year (£) of an alternative number of PIs within a naïve herd. Error bars represent the variation around the estimated costs, i.e. 95% percentiles.

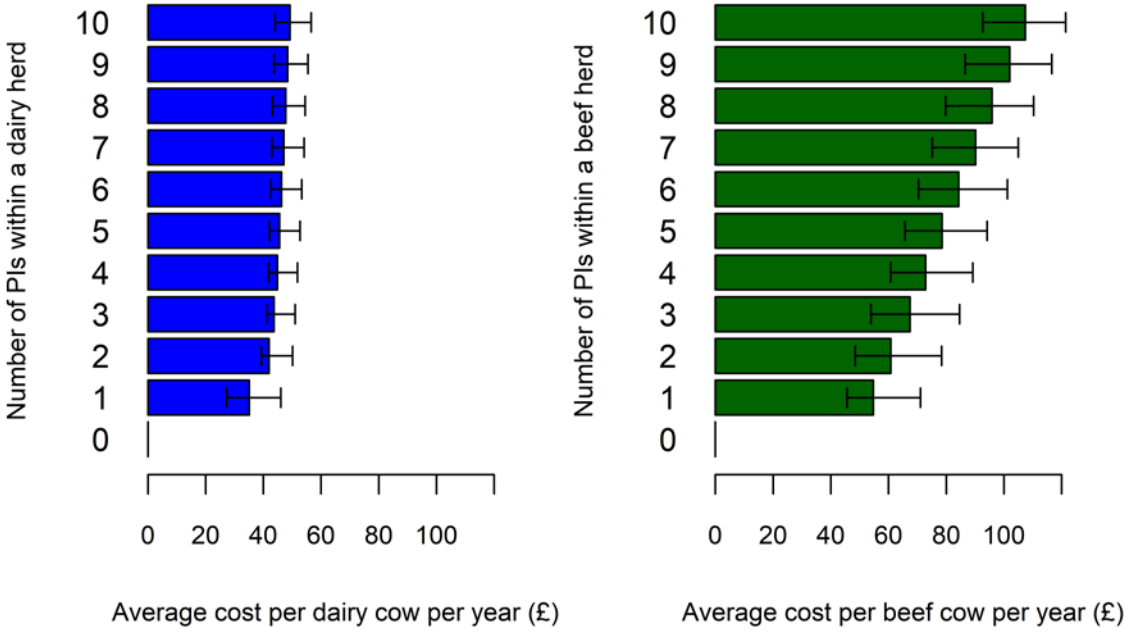

Table 1. Average milk yield lost per dairy cow (litres) and abortions per beef herd (%) per year associated with an alternative number of PIs within a herd.

Number of PIs within a herd	Average milk yield lost per dairy cow per year due to BVD (litres)	Abortions per beef herd per year (as % of transiently infected and susceptible cows)
0	0.0	0.0
1	64.5	5.6
2	76.1	5.7
3	78.0	6.0
4	78.9	6.0
5	79.5	6.1
6	79.8	6.3
7	80.3	6.3
8	80.4	6.5
9	80.5	6.7
10	80.9	6.7

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