

<p>Institution: University of Edinburgh and SRUC, Scotland's Rural College</p>
<p>Title of case study</p> <p>Control of bovine viral diarrhoea virus in livestock through evidence-driven behaviour changes on farms and through veterinarians.</p>
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Impact: Economic / animal health and welfare: Established health schemes to control Bovine Viral Diarrhoea (BVD) on Scottish farms and subsequently underpinned the rationale for cost-effective control strategies that have been adopted in health schemes around the UK. The farm-level savings to the industry from future eradication are estimated by Scottish Government to be £50-£80m.</p> <p>Significance: BVD is a major endemic disease of cattle in Scotland costing the dairy industry about £38M per year and an additional £11M to consumers.</p> <p>Beneficiaries: Farmers, cattle, animal health authorities.</p> <p>Attribution: Professors Gunn and Stott (SRUC).</p> <p>Reach: The associated health schemes began in Scotland (HI Health) and now operate throughout Britain (UK CHeCS (Cattle Health Certification Standards) Health Scheme). The research underpins BVD control schemes in Ireland and other EU Member States resulting in an avoided output loss of between €500 to €4,000 per dairy farm per year.</p>
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>BVD is a major endemic disease of cattle. Our researchers worked directly with cattle farmers and veterinary practitioners in Northern Scotland to generate knowledge to promote better collective approaches for control.</p> <ul style="list-style-type: none"> • Our researchers (Profs. Gunn (employed 1984-onwards) and Stott (employed 1983-onwards) conceptualised a risk analysis-based framework for priority endemic diseases, combining / integrating the best data available (deriving these as required) on the epidemiology of each pathogen with the economics of various interventions and also the attitudes of stakeholders to different control strategies. • A survey, funded by Quality Meat Scotland (QMS), indicated calf enteritis, calf pneumonia and bovine viral diarrhoea (BVD) as high priorities, so our approach was initially developed using pneumonia and enteritis in calves [3.1], then expanded to address BVD control. BVD infection, frequently occult in effect, weakens calf immune systems and so massively potentiates inter-current disease such as calf enteritis and pneumonia outbreaks. In the mid-1990s this was poorly understood by both farmers and their veterinary advisors. Consequently, our team made BVD a priority and evolved an integrated approach to dealing with this endemic disease complex. • Stakeholders, including policy teams, helped prioritise increasingly complicated and competing control options for BVD / enteritis and pneumonia. We concurrently designed the regional EC-funded cattle health scheme (HI Health) and consulted with stakeholders to derive realistic farm-level cost benefits of BVD prevention. This ultimately led to involvement in the development of an entirely new scheme for the whole of Britain: the UK CHeCS health schemes. Remarkable success was achieved through voluntary regional schemes. However, the animal health and welfare arguments, combined with cost benefit analyses, did not convince the majority of farmers and their veterinary advisors. We responded by researching and publishing findings on the reasons behind prevailing farmers' attitudes and identifying viable avenues for progression. • Mathematical modelling approaches for BVD control were developed in combination with economic approaches [3.2] and numerous information gaps (such as farm level biosecurity priorities, serological test interpretation and attitudinal surveys) were identified and investigated through our research, which extended to international level. The FP6 EC BVD network project

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extended impact through our role as joint team leader for the BVD economics work package with Saatkamp (Netherlands) [3.3] and more generally with Lindberg (Sweden) [3.4].

- Collaboration with behavioural scientists (Heffernan, Reading) demonstrated that the risk of herd infection rather than business losses were the main concern for farmers [3.5]. We raised awareness of the true prevalence of BVD infection in herds at Scottish level [3.6]. Our research highlighted BVD costs internationally, to the public, as well as farmers, and compared these with other diseases. We highlighted the considerable variation in impact depending upon epidemiological, social and economic circumstances. The potential positive contributions of BVD virus eradication, through optimising food conversion, to greenhouse gas mitigation were highlighted. Our work directly provided an evidence base for the BVD eradication programme in Scotland and elsewhere in the UK together with the cost-benefit arguments for Animal Health Ireland's current eradication programme [3.7]. Our approach established the concept of including social science, animal health economics, and farmer behaviour, when planning veterinary control programmes, which is increasingly adopted elsewhere.

Collaborators included Dr. Heffernan at the University of Reading, who carried out understanding of behavioural change work, and Prof. Brownlie of the Royal Veterinary College, who carried out vaccine development work.

3. References to the research (indicative maximum of six references)

3.1 Gunn G. J. and Stott A. W. (1997). A comparison of economic losses due to calf enteritis and calf pneumonia in Northern Scotland. *Épidémiologie et Santé Animale*. 31-32. (Copy available on request.)

3.2 Gunn, G. J., Stott, A. W. and Humphry R. W. (2004). Modelling and costing BVD outbreaks in beef herds. *Veterinary Journal*. 167: 143-149. DOI [10.1016/S1090-0233\(03\)00112-6](https://doi.org/10.1016/S1090-0233(03)00112-6)

3.3 Gunn, G. J., Saatkamp, H. W., Humphry, R. W. and Stott, A. W. (2005). Assessing Economic and Social Pressure for the Control of Bovine Viral Diarrhoea Virus. *Preventive Veterinary Medicine*. 72 (1-2): 149-162. DOI [10.1016/j.prevetmed.2005.08.012](https://doi.org/10.1016/j.prevetmed.2005.08.012)

3.4 Lindberg, A., Brownlie, J., Gunn, G. J., Houe H., Moennig, V., Saatkamp, H. W., Sandvik, T. and Valle, P. S. (2006). Perspectives on control of bovine viral diarrhoea virus (BVDV) in Europe – today and in the future. *OIE Scientific and Technical Review*. 25 (3): 961-979. (Copy available on request.)

3.5 Gunn, G. J., Heffernan, C., Hall, L. M., Mcleod, A. and Hovi, M. (2008). Measuring and comparing constraints to improved biosecurity amongst UK farmers and veterinarians. *Preventive Veterinary Medicine*. 84 (3-4): 310-323. DOI [10.1016/j.prevetmed.2007.12.003](https://doi.org/10.1016/j.prevetmed.2007.12.003)

3.6 Brulisaue, F., Lewis, F. I., Ganser, A. G., McKendrick, I. J. and Gunn G. J. (2010). The prevalence of bovine viral diarrhoea virus infection in beef suckler herds in Scotland. *Veterinary Journal*. 186 (2): 226-231. DOI [10.1016/j.tvjl.2009.08.011](https://doi.org/10.1016/j.tvjl.2009.08.011)

3.7 Stott, A. W., Humphry, R. W., Gunn, G. J., Higgins, I., Hennessey, T., O'Flaherty J. and Graham D. A. (2012). Predicted costs and benefits of eradicating BVDV from Ireland. *Irish Veterinary Journal*. 65: 12. DOI [10.1186/2046-0481-65-12](https://doi.org/10.1186/2046-0481-65-12)

4. Details of the impact (indicative maximum 750 words)

This research led to and underpinned the establishment of BVD eradication programmes in Scotland and then elsewhere in the UK by developing the eradication programmes; demonstrating the relatively low BVD prevalence in Scottish herds [3.6] and deriving the economic case for eradication at farm level. By providing such vital evidence in the form of results, already accepted by the cattle sector, the work also influenced government animal health policies on disease control and helped change how livestock industries approach the control of infectious diseases at both national and international levels.

Impact on Farming Behaviours: Through our work, the concept that for voluntary livestock disease control to succeed in Scotland, stakeholders have to be persuaded by i) clear information

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presented, by ii) trusted sources, and iii) an accessible format, has become much more widely accepted. The research has underpinned establishment of HI Health, which began a process that has led to the creation of the voluntary UK CHeCS. These schemes, which have now been running for 12 years, have encouraged ca 13,000 UK cattle farmers (equivalent to ca 15% of the national herd) to undertake measures to prevent and control specific infectious disease of cattle. In addition, this laid the foundations for the Scottish Executive to support a Mandatory Bovine Diarrhoea Eradication Scheme put forward by Scottish farmers. As examples, the impact of this research includes:

- Supporting a successful eradication scheme in Shetland by providing knowledge to support all levels of an intervention that has maintained Shetland's status as BVDV free for 20 years. Such support includes cost benefit estimates associated with re-introduction at farm level, expert consultancy and refinement of test interpretation.
- Underpinned the rationale of the Scottish BVD *Stage 1* eradication scheme where close to half of Scotland's beef herds and a third of the dairy herds signed up through a voluntary screening initiative.

Impact on Veterinary Practice: This research impacted by providing knowledge to convince the majority of cattle veterinary practices (the major referents for farmers about biosecurity issues) across Scotland of the rationale for engagement in BVD control schemes. This helped develop the underpinning stakeholder knowledge platform in Scotland whereby over 95% of Scottish cattle farmers have completed the compulsory Scottish BVD eradication scheme *Stage 2* on schedule.

Economic Impact: The research demonstrated BVD control results in an avoided output loss of between €500 to €4,000 per dairy farm per annum across Europe. In Scottish beef suckler farms we demonstrated an average saving of ca £2,000 per typical herd per annum. Given that there are about 1,000 BVD accredited farms in our health scheme, the total benefit from membership is ca £2M per annum. The research further demonstrated that a Scottish eradication scheme was, in net present value terms, economically beneficial delivering £11M to consumers through reduced milk price and £37M to dairy farmers through reduced veterinary costs and a greater sales volume (Weldegebriel *et al.*, 2009, Preventive Veterinary Medicine. 88: 49-56). Assuming similar benefits throughout the UK, equivalent national figures equate to £110M and £370M respectively as Scotland has approximately 10% of the UK dairy herd. These figures have directly impacted development of government policy that has now gone beyond the UK. As an example, the research has underpinned the rationale for Animal Health Ireland's new BVDV eradication programme which has saved the country over €100m/year compared to the cost (Net Present Value) of eradication from Ireland at €55m over 6 years.

5. Sources to corroborate the impact (indicative maximum of 10 references)

Individual users/beneficiaries who could be contacted by the REF team to corroborate claims:

- 5.1) Mr. Simon Hall, Veterinary Director Animal Health Veterinary Laboratory Agency (Ex CVO Scotland): Evidence base for BVD eradication, BTV8 vaccination programme and development of EPIC project <http://tinyurl.com/qczamxc>.
- 5.2) Prof. Jim Scudamore, University of Liverpool, (Retired CVO UK): Development of evidence base for both endemic and now exotic disease control <http://tinyurl.com/nbha9bj>
- 5.3) Mr Tim Brigstocke, Executive Director, Cattle Health Certification Standards UK Limited & Chair of GB Cattle Health & Welfare Group. Provision of BVD control programme to CHeCS and evidence base for stakeholders in particular vets and farmers <http://tinyurl.com/pdj3vpg>
- 5.4) Prof. Nigel Gibbens (CVO, UK): Provision of evidence base for endemic disease control <http://tinyurl.com/ntdkbu6>
- 5.5) Prof. Simon More (University College Dublin): Insight into HI Health model for farmer led disease control model with provision of BVD evidence base for Ireland <http://tinyurl.com/pyjc9dl>.

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- 5.6) Uel Morton, Chief Executive of Quality Meat Scotland: Establishment of disease priorities for Scottish farmers and provision of evidence base for endemic disease control <http://tinyurl.com/qhklbdo>
- 5.7) Dr Nick Ambrose (RESAS): Provision of evidence platform for BVD eradication <http://tinyurl.com/ok46qpr>

Selection of reports, reviews, web links or other documented sources of information in the public domain:

- 5.8) EC BVD Network Project Report references and is partially based on our work: "Position Paper BVDV Control in Europe" <http://tinyurl.com/q2dopmk>
- 5.9) CHeCS Technical Document is based on the HI Health programme and references our work from 2004 at <http://tinyurl.com/nv75vs7>

A selection of factual statements already by key users / beneficiaries corroborating claims made in the case study:

- 5.10) Scottish Government cite our work in a consultation document "Bovine viral diarrhoea (BVD): an eradication scheme for Scotland" <http://tinyurl.com/pdr35l6>
- 5.11) Animal Health Ireland cite our leading work using epidemiological and economic models developed for Scotland and applied to the situation in the Republic of Ireland to underpin their efforts to eradicate BVDV. <http://tinyurl.com/o549ury>