



Exploring the challenges to Bovine Viral Diarrhoea (BVD) eradication in Scotland

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Executive summary

Introduction

Bovine Viral Diarrhoea (BVD) is an endemic cattle disease in the UK, which causes scouring, infertility, abortions, illness and is seen to be responsible for significant production losses in the beef and dairy industries. The BVD eradication programme was introduced in Scotland in 2010, led by industry stakeholders and supported by the Scottish Government. This research examined farmers' and key stakeholders' experiences of the BVD eradication programme.

Methods

Interviews were carried out with beef farmers (9 in Aberdeenshire, 1 in Angus) and dairy farmers (14 in Dumfries and Galloway, 1 in Aberdeenshire, 1 in Angus), 2 livestock auctioneers and 2 expert vets and 3 key stakeholders. Seven farm videos were also conducted, either through a farm walk or farmer-recorded with a follow up interview.

Results

Why the BVD scheme is working

BVD is considered a 'straightforward' disease

BVD was framed by most farmers as an understandable, detectable and controllable livestock disease, and persistently infected (PI) cattle were understood to be the principle threat. Farmers also indicated that the tests for BVD were relatively reliable and easy to interpret.

There is an economic need to comply with the BVD scheme to sell animals

The BVD eradication scheme was having an impact on farmers through the formal sale of animals, since farms or individual animals must have a 'negative' BVD status for cattle to be sold.

BVD eradication is good for the industry

Some farmers were supportive of the BVD scheme because they saw it as good for the Scottish dairy and beef industries, and they generally saw eradication of BVD as good for the productivity and profitability of individual farms. It was considered fair that the scheme applied equally to all cattle farmers in Scotland with a breeding herd, and accepted BVD as an issue requiring collective action.

Recommendations for improving the BVD scheme

Measures to address 'neighbourly' biosecurity of main holdings and seasonal grazings

A key transmission route is direct contact between animals on neighbouring farms, but the scheme did not appear to significantly influence farmers' biosecurity practices relating to neighbouring farms and to farms used for seasonal grazing. Few farmers interviewed knew their neighbours' BVD status and there was limited awareness or use of the ScotEID system for finding out. A County Parish Holding (CPH) number is required to access another farmers' BVD status on ScotEID, but can only be acquired through establishment of an animal trading relationship. Farmers often perceived they had less control over the biosecurity of rented, seasonal grazing. There could be a greater emphasis in the scheme on biosecurity measures relating to nose to nose contact between animals on neighbouring farms. Ability to check other farmers' BVD status could in turn prompt the introduction of biosecurity measures to prevent nose to nose contact.

Recognise that a valuable animal is not the same as a 'disease free' animal

Farmers did not always report a straightforward relationship between BVD presence and productivity. To many farmers it felt counterintuitive to get rid of a 'normal', 'healthy' looking animal diagnosed as a PI, both if high value breeding stock (which often have strong emotional and cultural value), but also influencing the retention of low-value PIs on the farm to finish to help recoup losses. In some cases, farmers felt there was a business case for holding onto PIs if the costs of extensive testing, vaccination and culling of animals were estimated as more than costs of treating and management of chronic BVD infection. Different farmers differed in their estimation of BVD costs and benefits, depending in part on whether particular problems (e.g. failure to thrive, pneumonia) were seen as 'BVD' issues. Further measures may be required to prevent retention of PIs.

Tackle testing problems: in particular, increase trust in check test

Many farmers saw tag testing as the most reliable – albeit most expensive – testing method at the farm and national scales since every animal born onto the farm was tested and believed that PIs could not go undetected. However, problems with tag tests producing 'inconclusive' results (due to insufficient tissue in the sample) were common, especially with the most affordable tags. Re-testing was felt to be onerous for farmers and could result in a status change to non-negative. Farmers expressed a desire for more guidance about the best – most affordable and reliable tags to use. Some farmers expressed uncertainty about the accuracy of the blood sample 'check' test. Uncertainties related to the adequacy of small sample, and the frequency of testing. Farmers interviewed knew of PI animals 'slipping through the net' of the check test. Measures could be taken to improve the check test to address farmers' concerns about its accuracy. More guidance could be provided to farmers about the benefits of different tags in terms of convenient, ease of use, reliability and cost.

Acknowledge scheme fatigue and lack of capacity (versus will) to respond to scheme

Farmers widely believed that the regulatory and administrative burden they carry was too high, and that the extra costs required in terms of skilled labour, equipment and infrastructure were exacerbating farmers' financial struggles. This was particularly true for farmers identifying little choice but to put short-term profit before strategic investment or for those already 'left behind' in terms of knowledge, social, technological, labour, infrastructural and mental health resources. Punitive measures to force such farmers to comply could further compound these issues so in some cases increasing capacity to comply could be explored to help these farmers.

Clarify relationship between Scottish scheme and UK animal health management

Whilst some (especially beef) farmers saw the scheme as good for selling Scottish cattle-related commodities, others (particularly in Dumfries and Galloway) maintained that it made little political or logistical sense to create a scheme in Scotland separate from the rest of the UK. The long term plan for the BVD scheme in relation to disease status in the rest of the UK could be clarified to show how the scheme is being considered within the context of animal disease control in the UK.

Clarify BVD status change reasons and procedures

Farmers stated that they found aspects of the scheme difficult to understand and implement, particularly regarding the reasons for their status changing from negative to non-negative (e.g. whether administrative error, inconclusive tag test results, test timing, or transient infection), and how they should go about

regaining their status. The reasons for status change and ways to regain a negative status could be made clearer to farmers, through direct communication, veterinary involvement or through communication from labs.

Establish clear responsibilities for communicating BVD action points

Some farmers felt that others (vet or government) should clearly take responsibility for providing prompts at particular key junctures (e.g. when tests are due, when status needs checked, or explaining status changes).

Explore acceptability of financial support or compensation for removal of PIs

Farmers expressed mixed views about the possibility of compensation or financial support to incentivise farmers to remove PI animals from their herd. Some stated it could be unfair on farmers who have already done this voluntarily, but others took a pragmatic stance stating that it would be acceptable if it safeguarded the efforts of other farmers to eradicate BVD and resulted in the success of the scheme. If compensation for PIs is explored this would need to reflect farmers' concerns for fairness to farmers who have already taken action on BVD, and emphasize that action is taken to safeguard the public good of BVD eradication which has already taken place within Scotland.

Introduction

The Scottish bovine viral diarrhoea (BVD) eradication programme was introduced in 2010, led by industry stakeholders and supported by the Scottish Government. BVD is an endemic cattle disease in the UK, which causes scouring, infertility, abortions, illness and reduced growth and is seen to be responsible for significant production losses in the beef and dairy industries (Gunn et al., 2005). BVD is primarily spread by persistently infected animals (PIs) who were infected with the disease in utero and as a result have not developed immunity to the disease (Houe, 1993). PIs shed the disease throughout their lifetime and cannot be treated. The scheme has involved four stages: subsidised screening for the disease in the first stage; followed by mandatory screening in the second stage; movement restrictions based on BVD status in the third stage; and enhanced testing and further movement restrictions in the fourth stage (The Scottish Government, 2016). The fourth phase of the BVD eradication scheme began in June 2015 and introduced the rule that virus positive animals or PIs cannot be moved outside of the farm except to slaughter (The Scottish Government, 2016). Animals from non-negative herds must be individually tested for the BVD virus and be shown to be virus negative in order to be sold. Negative herds may test for BVD antibodies: using the blood test, or antigens using the tag test. The blood test involves testing a certain number of calves within separate management groups on the farm annually or more, depending on calving patterns (The Scottish Government, 2015). Non-negative herds are required to test for BVD antigens in all new calves born into the herd during the test year, or to carry out antigen tests on all the animals in the herd (The Scottish Government, 2015). The latest phase – phase 4 has removed the option for dairy farms to carry out milk testing for antibodies which was an option in previous phases (The Scottish Government, 2015).

The purpose of this study was to explore dairy and beef farmers', and key stakeholders' experiences of the BVD eradication scheme in order to inform the future development of the scheme. Interviews were carried out with beef farmers (9 in Aberdeenshire, 1 in Angus) and dairy farmers (14 in Dumfries and Galloway, 1 in Aberdeenshire, 1 in Angus), and 7 key stakeholders involved in the BVD eradication scheme. Seven farm videos were also conducted, either through a farm walk or independent video by the farmer with a follow up interview. Interviewing and video methods aim to explore the views and practices of a small number of actors in detail. Interview transcripts and video data were analysed to explore farmers' views on the strengths and weaknesses of the scheme. Mobile video ethnography (MVE) is an effective tool

in exploring everyday practices which involve tacit, embodied knowledge which may be difficult to verbalise (Brown and Banks, 2014; Brown and Spinney, 2010). Both Dumfries and Galloway and Aberdeenshire were chosen because they had a relatively high prevalence of BVD at the outset of the scheme (The Scottish Government, 2017) and Aberdeenshire has a high proportion of beef herds and Dumfries and Galloway a high proportion of dairy herds. Farmers were recruited through internet searches for beef and dairy farmers in these areas and through contact with livestock vets. In the following results the interviewees have been given pseudonyms to protect their anonymity.

Results

Why the BVD scheme is working

BVD is seen as a 'straightforward' disease

BVD was seen by many farmers as a 'straightforward' disease – in terms of its transmission pathways, diagnosis and treatment. The tests for BVD was seen to be reasonably accurate and understandable: the majority of farmers understood transmission routes and that persistently infected animals (PIs) were the largest risk, and that culling PIs was a necessary step to eradicating disease. BVD was contrasted with other less 'straightforward' diseases such as Johne's disease where the test was seen as difficult to interpret and unreliable, transmission between animals was more difficult to control, and there was no treatment for the disease.

Matt: At least with BVD there's a black and white test. It's a yes or a no answer. [...]. At least with BVD if you take a pretty strict and aggressive testing policy and take aggressive action you can eradicate it pretty quickly I would say. (Dairy)

Farmers generally saw compatibility between the strength of the evidence and the claims and actions taken based on it within the scheme. Such compatibility could be more difficult to achieve for less 'straightforward' diseases such as Johne's.

Cameron: When the Scottish Government first started saying they wanted to make Scotland a BVD free zone I couldn't understand what the hullabaloo was because you know it's the easiest thing on earth to do. I mean if they decided to make Scotland a Johne's free zone that would be huge headache. But BVD is a relatively easy one to attack first. (Beef)

Thus farmers felt that the nature of BVD lent itself to a disease eradication scheme.

BVD eradication seen as good for Scotland's beef and dairy industries

Some farmers were supportive of the BVD scheme because they saw it as good for the Scottish dairy and beef industries. They saw eradication of BVD as good for the productivity and profitability of the industries as whole and good for the reputation of Scottish beef and dairy industries abroad and among the general public.

Jack: The scheme in general, I think it's good that Scotland is trying to tackle it and it is a disease that we could eradicate so if everyone works together it makes sense. (Dairy)

Martin: No, I honestly had no bad feelings about the scheme. It cost us a wee bit of money but I felt it was there to serve a purpose and hopefully that it would be beneficial to everybody if it worked. [...] (Dairy)

Interviewer: What do you think of it in terms of the benefits, what would be the benefits?

Martin: Just animal welfare and you don't want to have animals on the farm that are – that have got a disease or are ill. I suppose it's better with the general public too, to see that we're keeping on top of things. (Dairy)

Alistair: I think it's the right thing. [...] Everything that can make our industry more efficient must be good for our global competitiveness. (Dairy)

Donald: [...] for us to progress on the world market we don't want to be known for diseased animals that have got BVD. If

you want to export and stuff like that you have got to be clean and we can turn around and say "Yes, we're clean". (Beef)

Farmers framed the scheme as fair because it required all cattle farmers with breeding animals to take the same action, meaning that work to eradicate disease by individual farmers was less likely to be undone by disease presence on other farms.

Iain: I think it's [the scheme] been really good, it's brought everybody's attention to it and made people aware. It's so easy just to be lackadaisical and say "it'll be fine", but, no, I think it works well and I think it's right that it's compulsory, if it's voluntary you always get some boys that don't do it. I know it can be harsh because you can't sell your cattle unless...but the majority of farmers that do it and some of them that don't care bring their cattle to the market and undoes all the good work that everybody else has done, it's pretty bad. No, I think the scheme has worked well. (Dairy)

Some farmers stated the scheme had been beneficial on their own farm, as well as for the industry as a whole.

Interviewer: So has the scheme had any impact on your farm, one way or another?

James: Well, we're higher health, we're aware of anything that's happening. Yes, I suppose it has, I suppose we are healthier, we think we're healthy. Aye, getting rid of BVD, you have no idea of what BVD is costing you, you don't get BVD, it's all the associated things; pneumonia, scours, it's the secondary things you get, or so my vet told me. (Beef)

Farmers saw the scheme as beneficial for them individually if it meant less stress about BVD entering their farm. Several farmers used the phrase "peace of mind" to describe the long term implications of the scheme.

Matt: The only thing that's good for me is if Scotland becomes BVD free I don't have to worry so much about my neighbours do I? That's the one peace of mind thing about it. (Dairy)

The scheme was seen as raising farmers' awareness about BVD. One farmer stated that the scheme had changed his interpretation of ill health in his animals.

Iain: In the past you'd have a cow that wasn't doing well or a calf that's not doing well and you just put it down as a sick animal and just say it's sick but now, you say "that could be BVD" and test it and if it is then you need to make sure it doesn't happen again whereas in the past you might have kept it and it could be spreading onto other cattle. (Dairy)

Economic need to comply with the scheme in order to sell animals

The main point at which the BVD was having an impact on farmers was through the sale of animals. A farm must have a "negative" BVD status in order to be able to sell animals, and if the farms' status is "non-negative" then an animal must be individually tested before it is sold.

Richard: I don't know an awful lot about it [the BVD scheme] to be honest apart from the fact that I know I've got to keep on top of BVD when it comes to selling [...]. (Beef)

It has become an expectation for farmers that animals they buy will be BVD negative, which is not the case with other common cattle diseases such as IBR (Infectious Bovine Rhinotracheitis) and leptospirosis.

Gordon: I think it's just BVD is just a standard you see so instead of having no BVD, BVD is just the new standard but then IBR and lepto and all that there are some folk that do vaccinate for it. It's up to them if they want to do it. But there's nae...you dinnae get any more money for it.

Interviewer: And has it always been that way that BVD is expected or is that recent?

Gordon: No! No! It's...well ever since it came out, ken ever since it became compulsory, it's just been the standard of it. (Beef)

When asked about testing for IBR and leptospirosis Donald states:

Donald: When I was properly in a health scheme I would have done the lot but there's so much hassle and I don't have it so

what's the point of me wasting my money and I'm not gaining anything out of being clear because I don't think people are overly concerned. The BVD status yes, that's a bit different but IBR it's just something to put on the animal's CV. (Beef)

Perception that PIs are dangerous

The main focus of the BVD eradication scheme is the removal of PI animals from herds. Many of the farmers interviewed understood PI animals in the same way as they are seen in the scheme: as a risk to their own herd, the national herd and saw no benefit in keeping them on the farm. Most of the farmers interviewed had a PI on their farm at one point.

Some farmers spoke about PIs in a way that suggested they saw them as dangerous and contaminated. A farmer who had recently discovered a PI on his farm stated that he didn't think the animals should be taken away live to a slaughter house but should have been killed as soon as possible on the farm to minimise the risk of contamination.

Stuart: That he should be allowed to go into a float and god knows where to the killing house, I thought he should have been shot and disposed of, but I don't make up the rules. (Beef)

Most saw PIs as an economic liability on the farm.

Interviewer: And why do you think some farmers hold on to them?

James: Ignorance and fear – they think they are losing money but keeping the thing is costing you a fortune. Your first losses are your best. Yes, if that's a problem they [the Scottish government] should force them to get the thing through, we can't afford PIs in the country, we should manage to eradicate them. (Beef)

Farmers spoke of the stress and emotional upheaval of getting a PI diagnosis and struggling to manage health problems in their herd.

Alistair: [Describing a false diagnoses of BVD in their herd] So it was just like... sleepless nights, the thought of disaster, that was our experience of BVD. [...] But, going back 20 years, 27 years, we brought in a bull and he was carrying BVD, we didn't know. We had a suckler beef herd at that time and we were both, I guess, naive, and it just went through us like a dose of salts: abortions, terminal...end of gestation, dead calves, fully formed dead, infertility. So we had a year, it was just everywhere, we were just dreading the next calving, you didn't know whether it was going to be alive or dead. (Dairy)

Interviewer: And how did you feel once you got the test back then?

Stuart: Oh, just bamboozled as to where and how. It had appeared and that was all there was about it, it was just a case of narrowing it down and get rid of it. (Beef)

James: Aye it's very depressing. Aye and you've had to treat them, it's not a nice place to be. They are nae thriving and you are jabbing them, horrible. (Beef)

Thus, as well as BVD causing suffering to animals, the presence of the disease also caused farmers suffering. Lessening the disease burden on the farm was also seen as beneficial for farmers.

Industry-government design of the scheme

The industry led design of the scheme, with legislative and previously funding support from government, was seen as an advantage of the scheme. This allowed for shared decision making and shared responsibility, with input from a wide range of experts and interests. A key stakeholder states:

Ruth: [...] it has the huge advantages that people, if you can engage them, they'll come and talk to you, they will point out the pitfalls so that you don't have to make the mistakes, which is massively valuable, and also, they'll feel ownership and involvement and perhaps that, the whole thing is more likely to be successful because the industry genuinely do feel like it's, they're part of it, and they are.

At the same time as the scheme benefiting from the input and expertise of many actors, the legislative underpinning was seen as necessary to achieve BVD eradication. A key stakeholder states:

Ruth: You can do so much with a voluntary scheme, but in

order for it to be successful it has to be put into law, it has to be at some point backed by law, even if it's run for a few years as a voluntary scheme, eventually, has it to be backed by law, because you won't catch everyone. Not everyone will volunteer to comply.

Thus the scheme was seen as having necessary elements for successful design and implementation.

Vulnerabilities in the scheme

Scheme not having an impact on 'neighbourly biosecurity' and seasonal grazing

Two of the most important transmission routes for disease onto a farm are seen as buying in animals and direct contact between animals on neighbouring farms (Shortall et al., 2017). As stated above the BVD scheme was having an impact on farmers' buying and selling practices. However, the scheme did not appear to be having an impact on farmers' biosecurity practices relating to neighbouring farms. Many of the farmers interviewed were unaware of the possibility of looking for another farmer's BVD status on the ScotEID website. A County Parish Holding (CPH) number is required to access another farmer's BVD status on ScotEID, but can only be acquired through establishment of an animal trading relationship, thus making it difficult to look up neighbour's status.

The scheme was also not having an impact on seasonal grazing movements. Farmers often perceived they had less control over the biosecurity of rented, seasonal grazing. Farmers reported that there can be struggles over responsibility for the installation of fencing to achieve necessary double fencing – issues centre on who should pay, who should lose land to the fence and who is the most careful/careless about biosecurity. Farmers also can perceive risk to their relationships by even entering into such negotiation. Farmers suggested that they felt less able to influence biosecurity on rented fields off farm which may receive less biosecurity scrutiny than their own. Some talked of own or other's instances of cattle 'coming back non-negative' after being away on rented grazing.

Uncertainty, confusion and error in the scheme

Farmers stated that they sometimes found it hard to interpret and understand the scheme. Farmers told stories about their status changing from negative to non-negative when they could not understand the reason behind it. Sometimes this was seen to be due to administrative error, inconclusive tag test results, a transient infection or other reasons which they never established. Thus, there was seen to be a mismatch between official BVD status and the actual presence or absence of disease. This cost farmers time in trying to resolve this, created negative feelings towards the scheme and opened up the possibility that BVD status was not necessarily reliable. Donald stated that his change in status was not fully explained to him.

Donald: What happened was that I bought some stores that are over at my brother's and they had come from an unreliable...I bought them through Thainstone [mart] and I think one was from Harwick or somewhere, I don't know what the hell they were doing up here but their BVD status was unreliable so they have to be tested and because they were tested I automatically I think it was never explained to me, I automatically go back a step. But as far as I know I don't have to test all the cattle, I'm still at the stage where those groups of calves that you saw there, five of them will be picked out that are over 9 months and they will be blood tested next week. (Beef)

Mary: I'm not sure how it came about but there was one point where our status changed and I'm not sure why it changed and I think that probably was an error because it changed for a few weeks and then went back again and I think we did sell something in that time and that got flagged up.

[...]

Mary: So we felt it was just another paperwork exercise and [...] I don't think the rules and regulations are particularly well set out and neither do I think that some of the things that they are asking we need to do in order to get your clear status, were particularly 100% effective. (Dairy)

Alistair describes a stressful administrative error in testing.

Alistair: [...] at the end of early April when we were just about to go and do some testing we got this very high BVD result from a second testing company which caused us to be put on the register for BVD positive herds, which meant that we weren't allowed to sell breeding stock and store cattle until we had gone through a series of tests to show that the herds were clear and that we'd dealt with the problem. Which we did, we tested the – the bulk test, we did the individual test through the milk and we did some blood tests of young stock over the next month. And couldn't find anything and it was only when we went back to re-check this high positive that we discovered that the farm code wasn't our code, it was the wrong farm and the data had been sent to us. So the panic was all for nothing. (Dairy)

Several dairy farmers stated that they had used bulk milk sampling at the beginning of the scheme which they stated produced inconsistent and confusing results and they perceived that there was not enough clarity about the scheme.

Interviewer: What was the testing regime like before?

Anthony: You would test the milk and you could be a one, two, three or a four, and because we were vaccinating that would affect – there would be antibodies in the milk and you didn't be able to seem to tell if they were antibodies because they had BVD or it was antibodies from the vaccination so they ended up having to look for – it just got that much complicated I couldn't...nobody seemed to come up with a way that we could get off being non-negative, not just us but other dairy farms as well. (Dairy)

A farmer described receiving a non-negative status because of an inconclusive tag test result.

Richard: The other slightly annoying thing with the tissue samples is you can sometimes get an insufficient sample and that could be for various reasons, the tag might not have been working properly, and the sample doesn't go into the tube. And so that an insufficient sample means that in theory your negative status is taken away as well, and you've got to wait I think it's a month before you can either blood test that calf or you can try and get a replacement tissue tag. It's one of these things that is a hassle basically, you've got to do the whole thing again and as I say probably the most annoying thing is it affects your BVD status and that's annoying because when you come to sell. (Beef)

Several farmers stated that there should be more communication to remind farmers when to test for BVD. The repercussions of missing a test were seen as significant because it would mean the inability to sell animals:

Emma: Well the only issue that I would have is that there are no reminders, nobody reminds you at all to do it, you have to remember. So that's the only issue. (Dairy)

Michael: And if you don't remember, well, we've lost our negative status. (Beef)

Reminding farmers when to test was usually a job carried out by the vet. But several farmers felt that there was too much of an administrative burden on farmers in compliance and more help should be given.

Farmers not communicating status in private sales

Previous research has shown that farmers often base decisions about buying in cattle partly on their knowledge of and trust in the seller farmer (Burton et al., 2012; Shortall et al., 2018). There was a reluctance to check the BVD status of animals traded privately. Research has shown farmers associate being a good farmer with having a clean farm and healthy livestock (Burton, 2004; Sutherland and Darnhofer, 2012) meaning that farmers may not want to risk offence by asking about animal disease. Many farmers buying privately either did not ask about status of the farm or animals, asked once early in the trading relationship but not for every transaction, or asked for verbal reassurance but not documentary proof.

Given that farmers understood BVD status did not map directly onto the presence or absence of BVD on the farm and that administrative mishaps and delays in the system meant that a

seller's status may be out of date or incorrect. In cases where a seller's account of their status contradicted their official BVD status, buyers would sometimes trust the seller's account. This was particularly true when farmers were buying in from another farmer they knew and trusted. Craig describes discrepancies between official BVD status and the farmer's account of it.

Craig: [...] we bought cattle in last year and we were home and it was found out then, they tested them before they'd sold them through an auction mart, they swore they did and the records hadn't been updated so I dinna ken but we retested them and they were clear, we did that just to reassure ourselves, we didn't have to do it but we got the letter through from the BVD office saying these cattle had arrived on our holding and should never have been moved off the holding they are on because they hadn't complied with the testing. So, we did them ourselves and they were clear, that's not the first time that's happened. I think they should get their own house in order, that's twice it's happened, cattle have moved on. One of them, I'm 100% she did test them because we've dealt with that people for twenty odd years and we go to holidays with them, they wouldn't tell me...this other ains were bought through auction, first time I've dealt with that man but he swore to me they were tested, the records weren't updated. [...] who did it wrong, like? It's just a body is so busy. (Beef)

Here Craig states he was willing to take the word of the trading partner he knew for 20 years over the information communicated by the scheme. This can be seen to make more sense in light of the descriptions above of confusion and error in the scheme.

Scheme fatigue

One of the most common negative sentiments farmers interviewed expressed about the scheme was the feeling that the regulatory and administrative burden on farmers was already too high: farmers already had too much paper work to do which cost them time and money. Farmers put this in the context of economic hardship in the farming industry and a heavy workload. The scheme cost them money through paying the vet to blood test or paying for tag tests. It cost them time through carrying out the tests, learning about the scheme and attempting to resolve any administrative confusion or discrepancies that emerged about their status.

Sarah: Because besides everything else, I suppose the farmers are going to hear "there's this new thing we're thinking about doing", and you go, "Oh no, not more money." Because farming at the moment and has been for a long time, we don't make money, we're making colossal amounts of loss. [...] And anything that the government or anyone else is talking about introducing to the agricultural industry is yet another thing that is crippling us all over again. (Dairy)

Many farmers who objected to the cost still expressed positive views about the scheme in general because they saw it as benefiting the industry. However, some of them did not wish to see similar schemes introduced in future for this reason:

Interviewer: And would you like to see other schemes for other diseases?

Gordon: Nae really! They cost more money. (Beef)

This is part of a wider issue of farmers feeling over regulated and burdened with paperwork and administrative tasks (Escobar and Demeritt, 2017).

Paul: There's definitely too much paperwork in farming anyway, I know that with a fact. We're only trying to make a living, we're no robbing anybody. [...] Well the transport certificates we're supposed to keep them for five year. We having got a building to keep them, it's a piece of nonsense.

Interviewer: And was that one of the reasons you didn't want to go into the scheme, that you didn't want additional...?

Paul: That's the main reason, we are no wanting any mair paperwork, we've had enough o' it.

Several farmers expressed confusion about how all the health and certification schemes and standards they were involved in overlapped and how they could ensure compliance with all of them simultaneously. While farmers interviewed generally understood the objectives of the BVD eradication scheme and

believed it was working towards these, the scheme was introduced within this context of a perception of overregulation and lack of autonomy.

Issues with tests

The tag test was also framed at times as more convenient than the blood test because farmers were tagging calves with an identification number anyway.

Tim (auctioneer): Everybody has to tag a calf so if one of the tags is producing a sample of tissue that can be tested, then that's a simple and probably cost-effective and management ease as well; you are not having to bring the cattle back in again to test them, if they've been tissue-tested.

Farmers used a variety of types of tag. Some used dual purpose "official" tags which showed the animal's BCMS number and took a tissue sample, or tags which just collected a sample. Several farmers stated they preferred using an official tag because it only involved tagging animals once as they did not want to administer too many tags to the animal: tagging the animals was a source of stress and tags were seen as a hazard which could get caught in things and potentially rip the animal's ear. Tags which fell out were replaced with another tag so as not to leave a hole exposed in the animal's ear.

Brian: The thing is, we the beef efficiency scheme, that the Scottish Government has, but I feel that we've got too many tags in cows. You've got two to identify it because if one falls out. If you are picked – if that calf is picked for the beef efficiency scheme for the DNA it gets another tag sample. Because the BVD tissue tag and that tag that cow now has got four tags in its ear. (Beef)

Tags were also seen as unreliable at times. Several farmers reported problems with test results being returned as inconclusive because an insufficient sample had been taken during tagging.

Greg [...] with the tissue testing, some of the samples, they were going to the labs and coming back as 'couldn't test the sample' or 'not enough tissue in the sample' so we could never get BVD free because it was coming back as a not-negative. If they couldn't sample the actual tissue sample, it came back as a not-negative. (Greg)

Several farmers expressed scepticism about the reliability of the blood sample test because it only involved testing a fraction of the herd. There was seen to be an opportunity for animals to slip through the net. Tagging animals was seen by many of the farmers interviewed as a more secure method of determining the herd's BVD status than blood sampling because all the animals born onto the farm would be tagged.

Interviewer: Do you think it [the BVD eradication scheme] will be successful in Scotland?

Martin: If everybody was ear notching [tag testing] I think it would have a better chance but...I don't know, I'm no sure of the ones who are doing batch blood testing, I don't think that's as accurate.

Interviewer: Why would you say that?

Martin: Well just that there's still a chance of getting a surprise, isn't there? (Dairy)

Interviewer: Do you have confidence in the results when you get them back or has that changed at all?

Craig: I suppose we're 100% confident they are right, aye, since we went onto the tissue sampling, individually sampling. You could pick five and miss the one [with the blood sample test], that's the problem, you do that for a year and you are two steps backwards. Because if that breeds in a cow because she's about to get bulled, you've done no good, have you? (Beef)

Interviewer: And were people more reluctant to buy them when you were non-negative or if the animals were individually tested, they were fine with that?

Iain: Yes, they were fine. The animals were individually tested. I think everybody knew everybody was trying, you'd tested, it was alright, it was fine. And if you test every animal then it's maybe better, people buy it because they know it's actually clear whereas we're only testing 10 but they should all have

contacted...you are selling them as a negative herd. But you've not tested everything. Whereas if somebody is testing every calf that is born through their ear tagging, maybe are more free [...]. (Dairy)

A stakeholder states that the time between tests is an issue for the reliability of the blood test:

Philip: In my view, the BVD screened negative, misleads a great many farmers because given that thirteen months can go by between your last screen-test, there's plenty of time for the virus to come in on that farm, between the last test.

The blood test is supposed to involve testing a number of animals in each management group on the farm with a management group being defined as animals with nose to nose contact (The Scottish Government, 2015). The vet needs to carry out the blood test, in contrast to the tag test which the farmer carries out themselves. It was stated that the negotiation between the vet and the farmer over which and how many animals to test could be difficult. A key stakeholder states:

Kevin: So, how do those negotiations go, so, the vet goes there and who knows what you expect, when you, maybe you don't have a relationship, especially if you're a new vet, and, then the farmer says "Here's five". Does the vet then say, "Well, actually, here's my sheet"?

For some, scepticism about the blood test was based on experience of the test.

Craig: I think the first time we tested it was okay and then the next year everyone was a reactor. I dinna think the test was up to scratch, to be honest, that was when we were doing the blood test, I don't know how accurate it was but I canna see how everyone was a reactor and they all went away fat, that's nae meant to happen, is it? (Beef)

One farmer kept a male calf as a breeding bull and then found out the animal was a PI. If the animal had not been kept as a breeding bull then it would've been sold before it was identified as a PI.

Interviewer: And would he have been sold then as a stock animal?

Stuart: Aye, he would have been sold as hopefully a breeding bull, that's what he was destined for. [...] Last December he could have been away. [...] I could have had him away and been none the wiser; standing there he was BVD free as far as I was concerned, it was only in the turn of the year that we tested that it appeared.

[...]

Interviewer: Do you think it's a good idea yourself, the scheme?

Stuart: [laughs] Well it certainly throws them up into the air if you've done a test, well you don't know but the amount of folk that test and get a clear result when they are maybe not 100% clear, because if I sold them in December and he would have gone into somebody – big feed lot, say boys that are feeding a few hundred, he would never have been tested again so nobody would ever have known. (Beef)

Several farmers interviewed saw the tag test to be more reliable and convenient than the blood test. Though the tag test was also seen as expensive and had potential for error if there was an insufficient sample.

Difficulties with stakeholder compliance

Compliance means relevant actors act in accordance with the recommendations of the scheme. With regards to BVD, compliance is required at a number of crucial steps. First vets carry out their own outreach to enrol farmers in their practice into voluntary schemes, and advise farmers to take steps to eradicate BVD on their farm. Second, marts must provide pathways so that the BVD status of traded animals is visible to their participants and stop animals which are not BVD negative from being sold during the compulsory phase of the scheme. Finally, farmers who identify PIs within their herd are recommended to isolate and cull them. The reasons for PI retention will be dealt with below. In some cases, the failure of compliance is seen as a threat to BVD eradication. It was stated by key stakeholders that even though there was legislation in place underpinning the scheme, it could be difficult to enforce compliance in practice. The division of

responsibility within government; funding and time constraints and the complicated nature of the BVD eradication scheme were seen as constraints on enforcement. As a key stakeholder states:

Philip: [...] up to now the enforcement has been in the hands of the local authority and trading standards who, I would say that their inspectors almost certainly don't understand the basics of how BVD works. And they probably don't have the resources and I think with what resources they do have they are more likely to use them on simple, easy things to do, which is probably going around and taking feed samples out of feed wagons. So I don't think that's an adequate. We've lobbied for APHA to be the enforcers but then they'll talk about resources and money and time.

It was seen as a difficult process for marts to advertise the BVD status of animals as well. A key stakeholder states:

Ruth: We finally agreed to implement phase four in that they must now be tested if they're going to a breeding herd, or you lose your status. But that should have been in in 2015, so that's taken just about three years to implement that, to kind of win everybody round and get them to agree to it, they're still really uncomfortable about it.

The discomfort may relate to farmer stigma around animal disease (Enticott and Vanclay, 2011): there have been other instances of reluctance to display disease status at marts, such as TB in Ireland (O'Donnell, 2018).

There was also seen to be difficulties ensuring veterinary involvement in the scheme because of varying degrees of knowledge and interest. A key stakeholder states:

Philip: And it was apparent that quite a number of vets did not even understand the basics themselves of how BVD works out. I think in the main that would be the case now but there is a huge variation in the approach of vets, to this day, I know, in terms of their attitude to BVD and BVD eradication, they are not together on that subject.

There were also seen to be a minority of farmers who would resist taking part in the scheme for a variety of reasons. Several farmers were encountered during the research who wished to have as little involvement with regulation as possible. One farmer had a non-negative status because he did not wish to take part in the scheme and be subject to government regulation, he did not investigate his non-negative status or attempt to obtain a negative status but tested each animal before selling it. Sarah describes a neighbour who tries to have as little involvement as possible:

Sarah: There's one that I'm fairly certain will be not-negative, that's the one we got the salmonella from, they don't even get Single Farm Payment because they refuse to allow the Ministry onto their farm. I sincerely doubt that they were anything other than not-negative. (Dairy)

These farmers were framed by others as impervious to peer pressure and would need to be forced to take action.

There were other farmers who were described as not complying with the scheme because they lacked the capacity rather than the will. These were struggling farmer who may be experiencing a cascade of difficulties in terms of health, labour, finance and infrastructure. In some cases, these farmers were thought to be socially isolated and not rich in social and human capital, not readily in the path of latest knowledge or lacking contacts, background or education to make easy sense of information. Farmers may be suffering from mental health problems and struggling to cope. A stakeholder states:

Emily: [...] people who come under fire for perhaps not doing things to as high a standard as people think they should be often people who actually need help rather than criticism, they are struggling to manage themselves and there's definitely a fair bit of that around.

For these farmers responding to BVD problems may be an issue of lack of capacity to take action in terms of time, energy and money, rather than a lack of will. Punitive measures to take action on BVD could further compound the difficulties these farmers were experiencing.

Retention of PIs

The primary means of eradicating BVD in the scheme is through the removal of PI animals. For many farmers, animal health is a complex issue involving social, economic and cultural components. For farmers animal health isn't just about the presence or absence of a pathogen such as the BVD virus. An animal's wellbeing, partly determined by immunity, is seen as having a role in health (Shortall et al., 2018; Wilkie, 2005), as Donald describes in relation to Johnne's disease:

Donald: The only reason why I think Johnne's would crop up is if the cattle are...it's when they're under a lot of pressure or stress or something like that. That's when it crops up. If you can keep that down to a very minor level then it's not going to crop up. They can cope with it that way. (Beef)

Thus, here the presence of a pathogen does not necessarily lead to ill health provided that the animals' immune system is functioning at a high enough level to cope with it. Farmers described managing the immunity of their animals as very important. Ill health is seen to also be the result of animal management – the conditions the animals are housed in and what the animals are fed.

Because the BVD scheme focuses on the absence of a pathogen it may not entirely mirror how farmers think about animal disease. Farmers may rely on their own stock keeping skills and ability to judge the health and wellbeing of animals by eye (Burton, 2004; Butler and Holloway, 2015; Shortall et al., 2018; Wilkie, 2005). When a farmers' own assessment conflicts with the vet or scientific assessment of the animal's health this was put forward as a reason why farmers may hold onto PIs.

Interviewer: I think they are having some problems with farmers holding on to PIs alright, do you have any views on why it might be farmers would hold on to their PIs?

Cameron: Well because there's nothing obvious wrong with them. The beast looks fine, and before you had scientists and vets telling you that there was something wrong with your beast, you would have thought there was nothing wrong with her. (Beef)

Several farmers stated that PIs still looked healthy.

Interviewer: And did the PI look any different to the others?

Stuart: [laughs] No, it's not different, and they didn't say! (Beef)

A farmer describes his ambivalence about culling a PI which appeared healthy. He describes the animal as "healthy", here presumably using that word to refer to a lack of symptoms:

Craig: The other ain't got shot last week, it was a healthy beast, it was a bit disappointing hae'n to put it doon but it was tested twice. (Beef)

Farmers have complex moral and economic norms around when animals on the farm are killed (Wilkie, 2005). As described by Craig putting down an animal that looked healthy and was not obviously suffering was an uncomfortable choice.

Animals had significance for farmers beyond their disease status. An animal's value could be based on a range of considerations that related to the farmer's own relationship with the animals and the characteristics that make them valuable to creating a profitable enterprise. These included the farmer's emotional and sentimental attachment to the animal, the animals' productivity, the animal's fertility, the animal's pedigree and lineage, the animal's exemplification of important breeding characteristics and success in shows. These considerations could be seen to trump the animal's disease status. Donald states in relation to Johnne's disease:

Donald: If I had to start culling out all the animals and everything I might end up with nothing at the end of the day. The other thing is it might end up being all my best cattle so what am I supposed to do? (Beef)

Thus a cow could still be one of his "best cattle" even if it had Johnne's disease, based on these other characteristics.

Farmers can have strong emotional attachments to their animals (Wilkie, 2005). This was given as a reason why a farmer may be reluctant to get rid of a PI animal: the emotional attachment

may take precedence over the disease risk the animal poses, particularly if the animal's disease status is not obvious to visual assessment.

Interviewer: do you know yourself why farmers might hold onto PIs or the reasoning behind that?

Emma: I mean, it might be a favourite cow! Ed's favourite cow – we've only got one and his favourite cow has got Johnne's. What do you do? It'll have to go but it's only one with Johnne's. And it's his favourite. And she doesn't look like she's got it, so that could translate to BVD I suppose. Maybe the PI is yielding. (Dairy)

Cameron: Och we've all had a pet cow we think "och we'll give her another chance at the bull", we've all done that [...]. (Beef)

In some cases, farmers felt there was a business case for holding onto PIs if the costs of extensive testing, vaccination and culling of animals were estimated as more than costs of treating and management of chronic BVD infection. Farmers differed in their estimation of BVD costs and benefits, depending in part on how particular problems (e.g. failure to thrive, pneumonia) were seen as 'BVD' issues. To many farmers it felt counterintuitive to get rid of a high value breeding stock (which often have strong emotional and social value). Some also stated low-value PIs may be kept on the farm to finish to help recoup losses. Some farmers stated that a sick animal may still be productive and worth keeping.

Sarah: At the end of the day, if the farmers choose not to get rid of that cow, either she's 1) still productive to him, even though she's a PI or 2) he's holding out for compensation by the Scottish Government to get rid of her. Or whatever at the end of the day, it was the case with Johnne's – if I've got an animal that's not profitable or not doing then I'll get rid of her. (Dairy)

A farm vets explains how the impacts of BVD may not be visible enough to prompt the farmer to take action:

Emily: But what they don't really perceive is the reduction in live weight gain, the growth stunting that happens. If you've got twenty calves in a shed and five of them are coughing and you treat those five because they are not well, there will probably be at least another five more that have had maybe some clinical disease that haven't had treatment but it still held back their growth rates.

[...]

Emily: If BVD is always there, well the problems grumble in a lot of cases and are accepted but again, with dairy farming when your margins are so tight and you are under so much pressure it seems like a no-brainer to get the place cleaned up of BVD, get rid of it. Having said that, I'm just trying to think of a fact that could be at play, could it be that actually margins are so tight that the short-term pain necessary to get the long-term gain is not tolerable. It could even be that.

Views on compensation for PIs

There were mixed views about the possibility of giving farmers compensation to remove PIs. Some felt that it was in the farmers' best interest so there was no need to compensate them.

Jack: If it was me personally I wouldn't really be looking for compensation because taking that PI animal away from the healthy animals is going to improve performance and that's going to be far more valuable than the compensation for the PI. (Dairy)

Several farmers stated it was unfair to compensate farmers who had not culled PIs.

Interviewer: And do you think farmers should be compensated if they have to get rid of PIs by the government?

James: It would have been, had we started with that system it could have been quicker, if you offer farmers money it's amazing what they'll do. But if you say you are taking an animal and not giving anything for it, it's not so good. We're too far down the line, I think, to do that now, we can't start compensating now when a body has done it, it's just the difficult ones that are left and we can't start and give them money since it's the best ones that have all accepted it. (Beef)

Several farmers stated that farmers can sell PIs for meat so they

get the market value for the animal already. Other farmers saw a precedent for compensating the removal of animals in schemes such as brucellosis eradication and thought that this may be necessary for pragmatic reasons because some farmers would not comply otherwise.

Matt: A farmer, if there is compensation there he's more likely to own up he's got a PI or get rid of it. If there's nothing there and it's just a case of selling it before its fat, or shooting it, or whatever, then you wouldn't get farmers complying as well. It depends how serious they are about wanting to eradicate it. If they are serious they probably have to compensate I would have said some of those animals. (Dairy)

Other farmers stated that a PI could be born in the herd through no 'fault' of the farmer and they could be compensated for the loss.

Interviewer: Do you think farmers should get compensated for getting rid of PIs?

Iain: Probably should actually, if it is a cost thing that they are not doing it for and they are getting compensation for them and if it's through no fault of their own they've got it and they are trying to get on top of it, it probably would be quite a good idea. As long as people don't go out and try and get it, that's the other thing! (Dairy)

Thus, there were a mixture of ethical and pragmatic arguments for and against compensating farmers to get rid of PIs.

Cross border disease transmission

For some farmers interviewed it did not make sense to have a BVD eradication scheme in Scotland separately from the rest of the UK.

Iain: [...] it [the BVD scheme] seems pointless in Scotland, we're just about fifteen miles from the English border so if we're doing everything right up here and they are not caring down there, it defeats the purpose a wee bit. (Dairy)

Some farmers described the scheme as politically motivated by a desire to separate Scotland from the rest of the UK. They saw the political motivation of the scheme as potentially at odds with the epidemiological rationale of making Scotland free of BVD, which some framed as unrealistic given Scotland's border with England and the amount of trading that took place.

Anthony: I don't think they thought the scheme through properly before they brought it in, they rushed at it to try and make a political statement, I think they are all saying that, but I kind of get that impression; this was all to do with wanting to put a clear blue water between us and the rest of the UK, Scotland a completely separate place. (Dairy)

Key stakeholders stated that transmission of BVD from other countries, particularly England, which were not operating a compulsory scheme was a vulnerability.

Recommendations

Measures to address 'neighbourly' biosecurity of main holdings and seasonal grazings

A key transmission route is direct contact between animals on neighbouring farms, but the scheme did not appear to significantly influence farmers' biosecurity practices relating to neighbouring farms and to farms used for seasonal grazing. Few farmers interviewed knew their neighbours' BVD status and there was limited awareness or use of the ScotEID system for finding out. A County Parish Holding (CPH) number is required to access another farmers' BVD status on ScotEID, but can only be acquired through establishment of an animal trading relationship. Farmers often perceived they had less control over the biosecurity of rented, seasonal grazing. There could be a greater emphasis in the scheme on biosecurity measures relating to nose to nose contact between animals on neighbouring farms. Ability to check other farmers' BVD status could in turn prompt the introduction of biosecurity measures to prevent nose to nose contact.

Recognise that a valuable animal is not the same as a 'disease free' animal

Farmers did not always report a straightforward relationship between BVD presence and productivity. To many farmers it felt counterintuitive to get rid of a 'normal', 'healthy' looking animal

diagnosed as a PI, both if high value breeding stock (which often have strong emotional and cultural value), but also influencing the keeping of low-value PIs on the farm to finish to help recoup losses. In some cases, farmers felt there was a business case for holding onto PIs if the costs of extensive testing, vaccination and culling of animals were estimated as more than costs of treating and management of chronic BVD infection. Different farmers differed in their estimation of BVD costs and benefits, depending in part on how particular problems (e.g. failure to thrive, pneumonia) were seen as 'BVD' issues. Further measures may be required to prevent keeping of PIs.

Tackle testing problems: in particular, increase trust in check test

Many farmers saw tag testing as the most reliable – albeit most expensive – testing method at the farm and national scale since every animal born onto the farm was tested and believed that PIs could not go undetected. However, problems with tag tests producing 'inconclusive' results (due to insufficient tissue in the sample) were common, especially with the most affordable tags. Re-testing was felt to be onerous for farmers and could result in a status change to non-negative. Farmers expressed a desire for more guidance about the best – most affordable and reliable tags to use. Some farmers expressed uncertainty about the accuracy of the blood sample 'check' test. Uncertainties related to the adequacy of small sample, and the frequency of testing. Farmers interviewed knew of PI animals 'slipping through the net' of the check test. Measures could be taken to improve the check test to address farmers' concerns about its accuracy. More guidance could be provided to farmers about the benefits of different tags in terms of convenient, ease of use, reliability and cost.

Acknowledge scheme fatigue and lack of capacity (versus will) to respond to scheme

The feeling that the regulatory and administrative burden on farmers was already too high was widespread, and that the extra costs in terms of skilled labour, equipment and infrastructure were exacerbating farmers' financial struggles. This was particularly true for farmers identifying little choice but to put short-term profit before strategic investment or those already 'left behind' in terms of knowledge, social, technological, labour, infrastructural and mental health resources. Punitive measures to force such farmers to comply could further compound these issues so in some cases increasing capacity to comply could be explored to help these farmers.

Clarify relationship between Scottish scheme and UK animal health management

Whilst some (especially beef) farmers saw the scheme as good for selling Scottish cattle-related commodities, others (particularly in Dumfries and Galloway) maintained that it did not make political or logistical sense to create a scheme in Scotland separate from the rest of the UK. The long term plan for the BVD scheme in relation to disease status in the rest of the UK could be clarified to show how the scheme is being considered within the context of animal disease control in the UK.

Clarify BVD status change reasons and procedures

Farmers stated that they found aspects of the scheme difficult to understand and implement, particularly regarding the reasons for their status changing from negative to non-negative (e.g. whether administrative error, inconclusive tag test results, test timing, or transient infection), and how they should go about regaining their status. The reasons for status change could be made clearer to farmers and ways to regain a negative status, through direct communication, veterinary involvement or through communication from labs.

Establish clear responsibilities for communicating BVD action points

Some farmers felt that others (vet or government) should clearly take responsibility for providing prompts at particular key junctures (e.g. when tests are due, when status needs checked, or explaining status changes).

Explore acceptability of financial support or compensation for removal of PIs

Farmers expressed mixed views about the possibility of compensation or financial support to incentivise farmers to remove PI animals from their herd. Some stated it could be unfair on farmers who have already done this voluntarily, but others took a pragmatic stance stating that it would be acceptable if it safeguarded the efforts of other farmers to eradicate BVD and resulted in the success of the scheme. If compensation for PIs is explored this would need to reflect farmers' concerns for fairness to farmers who have already taken action on BVD, and emphasize that action is taken to safeguard the public good of BVD eradication which has already taken place within Scotland.

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