

Ruminant Health & Welfare

Cattle and sheep health and welfare priorities – a
'grassroots' survey across the four nations of the UK

MAY 2021



Survey carried out by RH&W
Analysis and report generated by AHDB, with additional commentary from RH&W

www.ruminanthw.org.uk

Foreword – Nigel Miller

“ In November and December 2020, the Ruminant Health & Welfare steering group devised and disseminated a ‘grassroots’ survey through a wide number of willing organisations in its membership.

The survey was aimed at establishing the disease, health and welfare priorities of those who work with cattle and sheep on a daily basis, and was necessarily long and involved. As a result, we had no idea of how well it would be received and how many forms would be completed. So we were delighted to have 662 submissions to analyse and would like to thank all those who participated and helped to spread the word and encourage participation.

We would also like to thank AHDB, which has invested considerable time and effort analysing and interpreting the results. Its work has given some considerable food for thought.

I want to briefly focus on some key points of interest:



Sheep

The sheep disease priorities underline the importance of common conditions and the real threat that parasites pose to flock health and welfare.

Perhaps it is not surprising that footrot scores so highly. Nobody can doubt the corrosive impact on body condition and welfare and the indirect ripple effect which threatens the performance and, at times, the survival of lambs from affected ewes. That Contagious Ovine Digital Dermatitis (CODD) also ranks as such a significant priority might not have been predicted but emphasises the severity of the condition. It may also, unfortunately, indicate its increasing reach into the national flock.



Cattle

The cattle disease survey scores confirm some established priorities with both digital dermatitis and Johne’s disease seen as major threats across sectors. Infectious Bovine Rhinotracheitis (IBR) and Bovine Viral Diarrhoea (BVD) both still rank highly, even though extreme IBR outbreaks appear to be less common and the threat of BVD has subsided due to eradication progress.

The priority status of viral pneumonia (RSV, PI-3) is interesting, and pinpoints a recurring threat on many holdings. At a time when vaccination programmes are at the centre of the health management debate this may increase interest in that proactive approach.

Introducing syndromes as a route into disease control or active health planning after an assessment or investigative phase is, I hope, a real step forward. The potential efficiency gains from addressing syndromes are often way beyond individual disease impacts.

Clearly disease is often the visible component of a syndrome with nutrition, environmental factors and genetics also involved at times. Moving health management to a whole system approach can open the door to more significant progress.

In identifying the key syndromes across the ruminant sector, I hope the survey can provide impetus for that journey. Active investigation and health planning; underpinned where appropriate by a holistic or team approach, will be important.

These results are some of the first that truly take into account those at the coalface of farming, who deal with these diseases and conditions on a daily basis. It forms a critical benchmark against which to compare other resources such as recent reports from ADAS, Animal Health Ireland and Livestock Health Scotland.

The RH&W steering group is a unique collection of individuals who can share information across the four nations and collaborate to find solutions. It will now take these results forward to a workshop where priorities will be discussed, existing interventions established and gaps identified where RH&W could facilitate or speed progress and the overcoming of any barriers.

We look forward to this report playing an important role in the setting of strategic goals and activities for RH&W and the wider industry across the four nations over coming years.



Nigel Miller, chairman RH&W



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Executive summary

Headlines

The survey yielded 662 usable responses, of which 76% were farmers and 34% were professionals (eg vets and advisers), indicating that 10% were both. Of the farmers, 81% worked with cattle (of which 27% were dairy and 73% beef), and 54% worked with sheep (17% on hill land, 28% upland and 55% lowland).

Irrespective of the type of impact the questions related to, whether the views were local or national or whether the respondent was a farmer or professional, the top priority diseases and syndromes were relatively consistent. Syndromes are broader conditions caused by a range of potential factors or pathogens, and commonly associated with particular stages in the production cycle.

Top diseases impacting sheep production and welfare in the UK were:

- Footrot
- CODD
- Sheep scab
- Liver fluke
- Fly strike
- Parasitic gastroenteritis (PGE)

Top syndromes impacting sheep production and welfare in the UK were:

- Neonatal lamb disease or mortality
- Reproductive failure
- Anthelmintic resistance
- Joint ill
- Mastitis

Top diseases impacting cattle production and welfare in the UK were:

- Digital dermatitis
- BVD
- Johne's disease
- Liver fluke
- Viral pneumonia (PI-3, RSV)

Top syndromes impacting cattle production and welfare in the UK were:

- Lameness
- Reproductive failure
- Neonatal or calf disease
- Mastitis (sub-clinical and acute)
- Bovine respiratory disease (BRD)

Key insights

Generally, professionals scored the impact of diseases and syndromes higher than farmers, though farmers rated some conditions, such as fly strike, higher than professionals.

These differences may partly result from farmers seeing more of the day-to-day issues on a farm that they wouldn't necessarily call the vet out for, and vets having a broader range of experience than farmers from visiting numerous farms and sometimes only seeing the more extreme impacts. Differences between professional and farmer opinions were more pronounced in sheep, which may be down to vets being less likely to be called out for an individual sheep than a cow or calf.

Importantly, professionals were far more concerned about antibiotic resistance and its impact on animal welfare than farmers, which suggests that resistance levels are not being monitored on farms, however huge progress has been made in this area with effort from all parties.

With cattle farmers in particular, some variation in priorities between enterprise type was observed. The most pronounced of these were liver fluke being a

higher priority for beef farmers, while dairy farmers placed a higher priority on digital dermatitis. However, lameness was a key concern for all, with significant impacts on dairy.

The most notable difference in priorities between sheep farmers was flukicide (triclabendazole) resistance, with hill and upland farmers scoring it higher than lowland farmers. This trend was also observed in the regional data with farmers in Less Favoured Areas (LFAs) and hillier regions scoring it higher than those in non-LFAs and mid- and southern-England. This finding is consistent with fluke forecasting and illustrates that liver fluke and flukicide resistance are a major problem in hill and upland areas.

Lowland farmers scored the impact of metabolic disease higher than hill and upland farmers, particularly with respect to production efficiency. It is possible that lowland farms experience metabolic disorders from introducing feed when ewes are housed or from heavily-stocked grazing, where not all ewes can access feed. Ewes with multiple lambs are often more susceptible to metabolic diseases as well.

Next steps

The findings of the survey will be taken to a workshop with the RH&W steering group and invited 'champions' from each sector drawn from the farming, veterinary and research worlds, in summer 2021. The workshop challenge will be to ask how the four nations can work together to deliver a new operating environment to deliver fresh and tangible progress against these priorities. A range of possible interventions will be identified based on relevance, cost and likelihood of adoption.

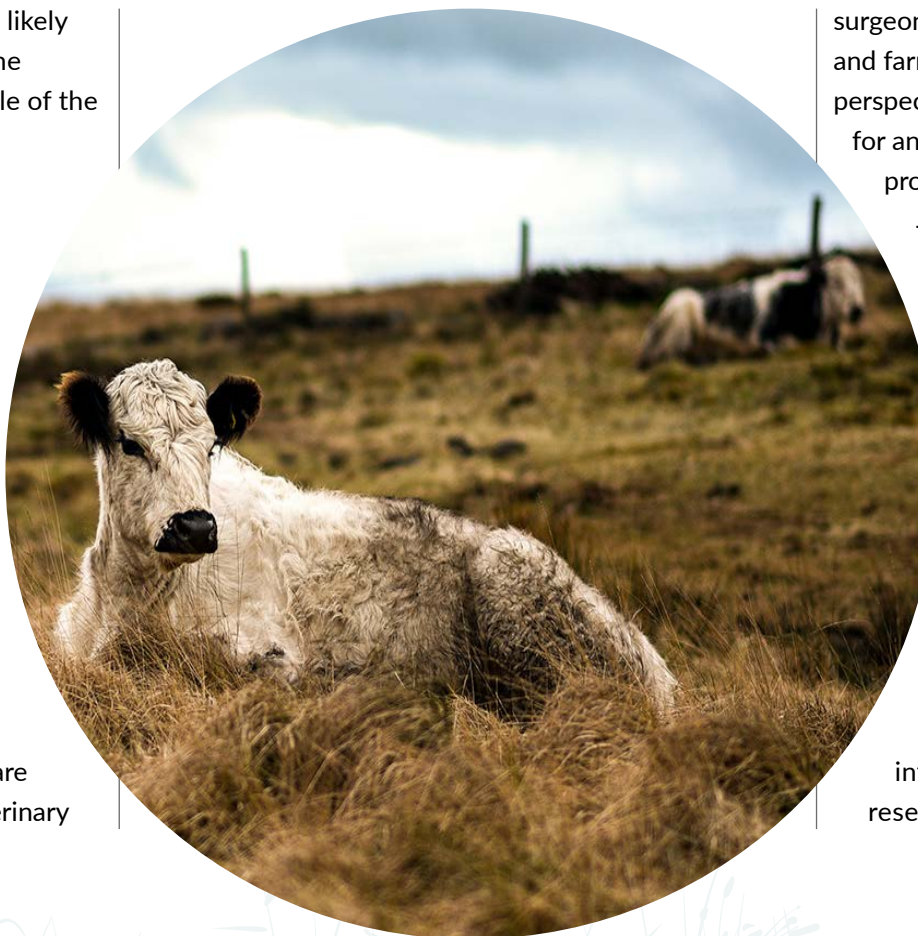
The need for a national or regional response will be one consideration, based on how the intervention could reduce risk of health status breakdowns, improve livestock performance, support low risk trading and positively impact other live industry challenges such as greenhouse gas emissions or antimicrobial resistance.

1. Introduction

Perception of animal diseases and syndromes is likely to vary depending on the species in question, the geographical location of the animals, and the role of the person whose opinion is being sought.

Veterinary opinion is considered a robust way to prioritise the importance of diseases and syndromes. However, diseases that are treated by the farmer/stockperson may not be given the warranted attention as they might not be observed as frequently by vets. On the other hand, farmers tend to only see what is common on their farm, while vets will be exposed to many different health and welfare issues on multiple farms. Thus, the opinions and experience of both are needed to inform industry priorities.

Ruminant Health & Welfare (RH&W) is a recently formed group of industry stakeholders whose remit is to tackle priority health and welfare issues. In this study, it sought opinions from veterinary



surgeons, other livestock professionals, stock handlers and farmers over the priority diseases from different perspectives. For ease, those with primary responsibility for animals are described as farmers and those providing services to farmers as professionals.

The opinions of both were collected via an online survey about the impact of diseases and syndromes facing UK sheep and cattle (beef and dairy) industries. The survey also required respondents to rate the impact of those diseases on production efficiency, animal welfare and market access. Responses were categorised by farmers and professionals, the species they dealt with and their geographical region.

The results, along with input from stakeholders and the support of scientific expertise, will feed into RH&W's activities, inform future strategy, and may influence future research programmes.

2. Materials and methods

2.1 The survey

The survey was conducted during November and December 2020 and was designed to take a maximum of 20 minutes to complete. The survey was produced and managed in SurveyMonkey (SurveyMonkey®) and distributed via stakeholder groups within the ruminant sectors.

Those interested in participating were directed to a landing page on the RH&W website which contained details of the survey, and how any personal data would be stored or used. Participants were invited to provide their name and contact details if they wished to subscribe to the RH&W newsletter or be entered for the chance to win one of four farmhouse hampers worth £50, but these details were not attached to survey responses, which remained anonymous.

Initial questions gathered information about the participant's role and location. Respondents were then asked closed questions about impacts of diseases and syndromes, using a six-point Likert scale: No impact, low impact, low-medium impact, medium impact, medium-high impact, high impact. An option for 'unsure' was also provided. Additionally, a number of other open questions were included to allow for a greater degree of reflection on the respondent's part, as well as allowing the survey team to comprehensively evaluate the responses.

2.2 Demographics and geographics

Respondents were asked to classify their role from the following list of options: farmer or farm manager, stockperson or shepherd, livestock adviser or consultant, veterinary surgeon, Suitably Qualified Person (SQP)/Registered Animal Medicine Adviser (RAMA), livestock service provider (eg clipping, foot trimming, relief services), food processing or retail supply chain, person working within an animal welfare organisation, or 'other'. Participants were able to select more than one role (eg a number of farmers who responded to this survey were also professionals). Respondents were also asked to identify the region in which they mostly operated.

If respondents identified as working with sheep, they were asked where their flock was located (hill, upland or lowland) and which of the following was their main sheep enterprise: store lamb production, breeding stock production, breeder finisher, lamb finisher, wintering or seasonal grazing, dairy sheep, or other. If respondents identified as working with cattle, they were asked which of the following were key parts of their business: dairy cattle, suckler beef cows, dairy beef systems, beef finishing systems, or other. Again, participants were able to select more than one option.

2.3 Diseases

Lists of diseases were developed by members of RH&W based on experience, relevant studies and newsworthy conditions.

Fifteen sheep diseases were presented for consideration from the perspective of personal and local priorities for sheep farmers and professionals. These were Caseous Lymphadenitis (CLA), Maedi Visna (MV), Johne's disease, Ovine Pulmonary Adenocarcinoma (OPA)/Jaagsiekte, listeria, EAE/enzootic abortion/chlamydia, toxoplasmosis, Pasteurella, parasitic gastroenteritis (PGE), sheep scab, liver fluke, fly strike, emerging vector-borne disease (eg Bluetongue, Schmallenberg), footrot and contagious ovine digital dermatitis (CODD).

Cattle farmers were presented with 19 cattle diseases for consideration. These were Bovine Viral Diarrhoea (BVD), Johne's disease, Infectious Bovine Rhinotracheitis (IBR), Leptospirosis, viral pneumonia (PI-3, RSV), *Mycoplasma bovis*, Cryptosporidia, Neospora, *Campylobacter fetus*, summer mastitis/August bag, *E.coli* O157, parasitic gastroenteritis (PGE), lungworm, liver fluke, *Psoroptes bovis* (cattle scab), emerging vector-borne disease (eg Bluetongue, Schmallenberg), *Salmonella Dublin*, digital dermatitis and Q fever.

2.4 Syndromes

Respondents were asked to select up to three of these diseases which, in their experience, had the greatest impact on flocks/herds they worked with and other flocks/herds in their locality, with a particular focus on diseases impacting productivity and/or welfare. For their selected top three diseases, respondents were then asked to indicate the scale of impact these diseases had on production efficiency and animal welfare in separate questions, scoring on a six-point Likert scale.

Respondents were also asked to select up to five diseases which they believed to have the most impact on herds/flocks at a national level, with a particular focus on productivity, consumer perceptions/industry reputation and market access. For their selected top five diseases, respondents then used the same six-point Likert scale to indicate the scale of impact these diseases had on production efficiency, market access and industry reputation (including public safety).

In the survey, broader conditions caused by a range of potential factors and commonly associated with particular stages in the production cycle were defined as 'syndromes'.

Sheep farmers and professionals were presented with 12 syndromes which they were asked to consider from the perspective of personal and local priorities. These were reproductive failure (eg infertility, abortion or stillbirth), metabolic disease (eg twin lamb, hypocalcaemia), neonatal lamb disease or mortality (eg watery mouth, scour), joint ill, ill-thriven lambs, mastitis, tick borne disease (eg tick borne fever, louping ill), photosensitisation, involuntary or premature culling of ewes, anthelmintic resistance, flukicide (triclabendazole) resistance and antibiotic resistance.

Eleven cattle syndromes were presented for consideration, which were reproductive failure (eg infertility, abortion or stillbirth), neonatal or calf disease (eg scour, navel ill, pneumonia), bovine respiratory disease (BRD), acute mastitis, subclinical mastitis, transit or shipping fever, metabolic disease, lameness, involuntary or forced culling of breeding stock, flukicide (triclabendazole) resistance and antibiotic resistance.

Respondents were asked to select up to three of these syndromes which, in their experience, have the most impact on productivity or animal welfare in herds/flocks they work with and other herds/flocks in their locality. As with the disease-related questions, the six-point Likert scale was used to score impact on production efficiency and animal welfare.

2.5 Data management and analysis

Responses were collected using SurveyMonkey. Data was exported to Microsoft Excel for analysis. In the analysis, farmers, farm managers, stockpeople and shepherds were grouped as 'farmers' and those who provide services were grouped as 'professionals'. Sheep groups were split into 'hill', 'upland' and 'lowland'. Cattle groups were split into 'dairy' and 'beef'. These groups were not mutually exclusive as respondents could select more than one option.

Impact scores were converted to a numerical Likert scale (0-5) where 0 = no impact, 1 = low impact, 2 = low-medium impact, 3 = medium impact, 4 = medium-high impact, 5 = high impact. 'Unsure' responses were discounted. Descriptive analysis was carried out to calculate the median impact score for each disease, split into 'professional' and each type of 'farmer' group for sheep and cattle.

The median impact score for each disease was weighted by multiplying the percentage of respondents who selected each disease as one of their top priorities. Diseases were then ranked based on these weighted scores in relation to each question asked. The data was also looked at from a regional perspective.



3. Results: Participants

In total, there were 738 responses but 76 were discounted, mainly due to failure to complete, leaving no usable data; this left 662 valid responses to the survey. Of the 662 respondents, 505 (76%) identified as farmers (ie those with primary responsibility for animals), 222 (34%) as professionals (ie those who provide services to farmers and stock workers) and 65 (10%) as both (Figure 1). Of the farmers, 409 (81%) said they worked with cattle (of these, 27% were dairy and 73% beef) and 271 (54%) worked with sheep (17% were hill farmers, 28% upland farmers and 55% lowland farmers).

Professionals represented the broad range of contributors to animal health and welfare in the UK and the majority worked with both cattle and sheep. Of the professionals who responded to this survey, 160 (72%) were veterinary surgeons and 39 (18%) were livestock advisers/consultants. The remaining 10% were a combination of other professions.

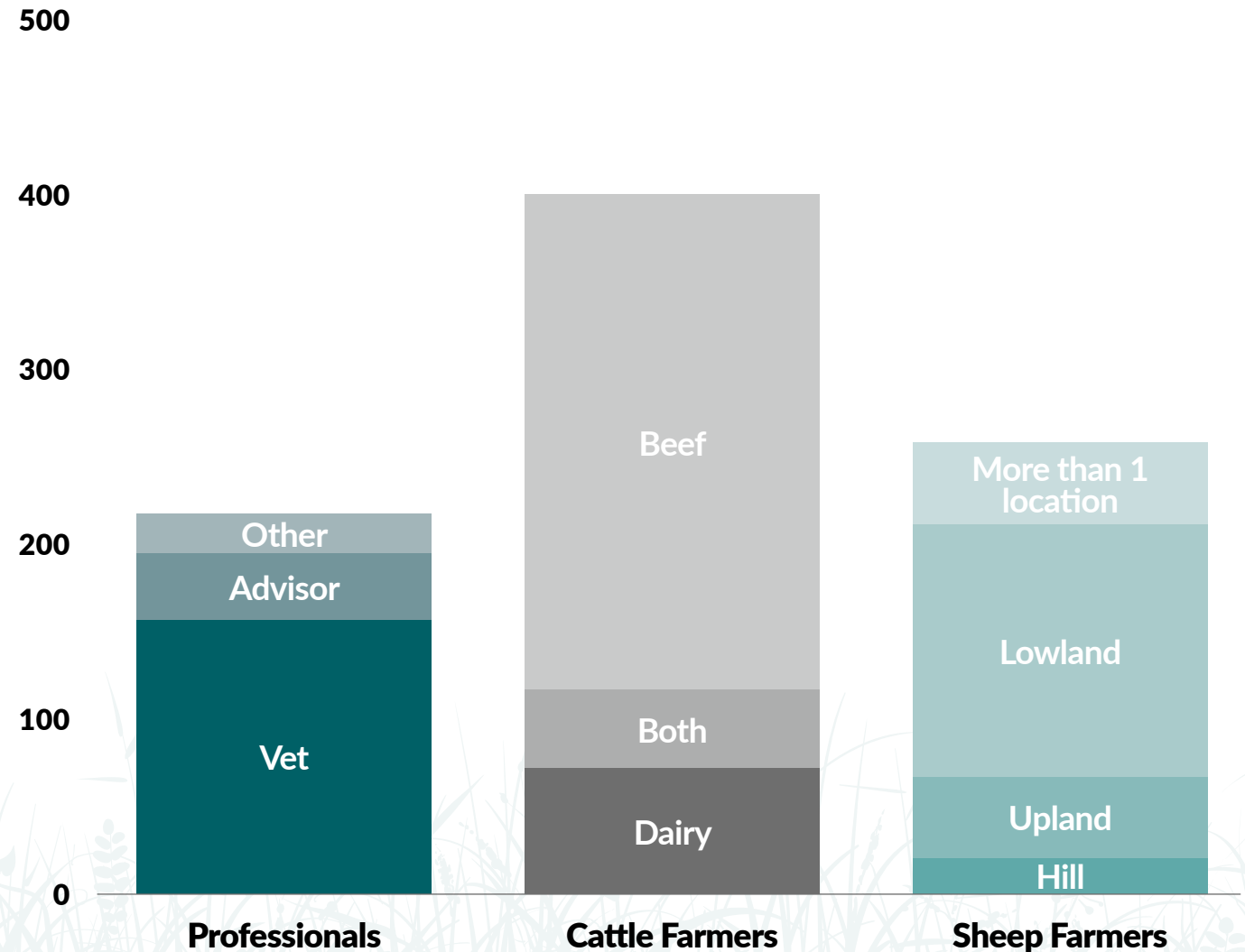


Figure 1. Number of survey respondents split by role and enterprise type

3. Results: Participants

The greatest number of beef farmer respondents were located in Scotland Less Favoured Areas (LFA), Wales LFA and south west England, while the greatest proportion of dairy farmers were located in south west England and Wales non-LFA.

As expected, the largest proportion of sheep hill farmers were from Scotland LFA, Wales LFA and the North of England, while the largest proportion of lowland farmers were from southern England, the Midlands and Wales non-LFA.

Figure 2 illustrates the regional distribution of the respondents. Overall, all regions were well represented in the survey. The largest proportion of respondents (20%) were from the South West of England. Other regions were relatively evenly represented.

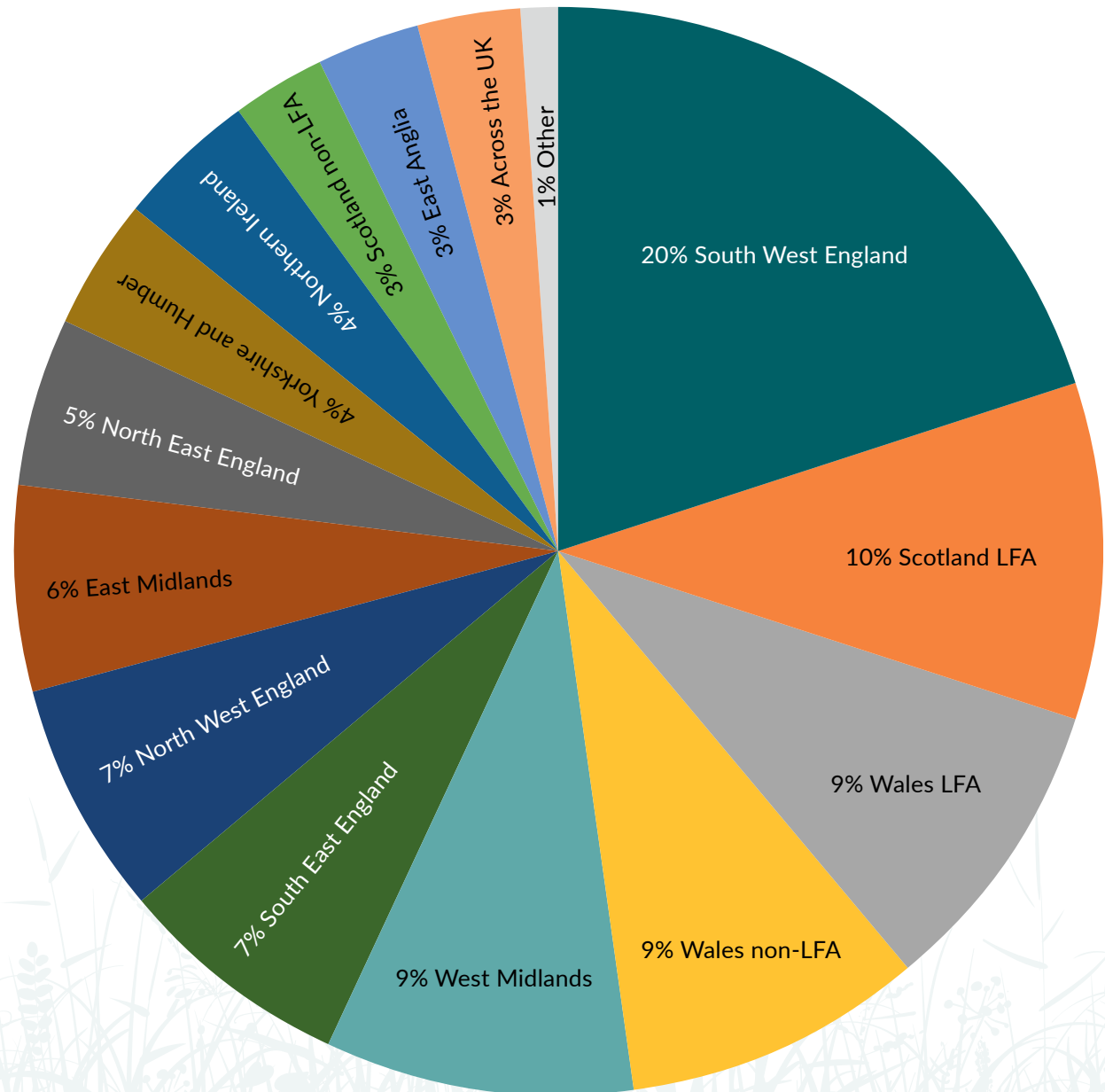


Figure 2. Regional representation of respondents in the survey

- 20% South West England
- 10% Scotland LFA
- 9% Wales LFA
- 9% Wales non-LFA
- 9% West Midlands
- 7% South East England
- 7% North West England
- 6% East Midlands
- 5% North East England
- 4% Yorkshire and Humber
- 4% Northern Ireland
- 3% Scotland non-LFA
- 3% East Anglia
- 3% Across the UK
- 1% Other

4 Results: Sheep

4.1 Topline results

The results of this study found that the exact priority order of the diseases and syndromes varied slightly depending on whether the questions related to impact on production efficiency, animal welfare, market access or industry reputation, whether they were local or national views and whether the respondent was a farmer or professional. However, responses from farmers and professionals agree that footrot and CODD are top priorities - yet there is inconsistency in that lameness does not feature in the syndromes.

Top diseases impacting sheep production and welfare in the UK:

- Footrot
- CODD
- Sheep scab
- Liver fluke
- Fly strike
- Parasitic gastroenteritis (PGE)

Top syndromes impacting sheep production and welfare in the UK were:

- Neonatal lamb disease or mortality
- Reproductive failure
- Anthelmintic resistance
- Joint ill
- Mastitis

Farmer and professional responses for 15 sheep diseases with median impact scores on production efficiency at a local and national level, and 12 sheep syndromes with median impact scores on production efficiency and animal welfare, are presented in Tables 1 to 4.

Results from the open questions identified additional diseases/syndromes not included in the survey lists. Most frequently cited were trace element deficiencies and Border Disease.

4.2 Personal and local priorities of sheep diseases based on perceived impact on production efficiency and animal welfare

The top priority for all groups (professionals and farmers) when asked about impact of sheep diseases on production efficiency and animal welfare in flocks they worked with or in their locality, was footrot. Professionals scored this higher than farmers on both, with a particularly high impact score against animal welfare.

Of note, all groups scored CODD as high impact on animal welfare and medium-high on production efficiency. Due to the number of respondents that selected CODD as one of their top priority sheep diseases, it was ranked higher in the professionals'

priority list than the farmer groups.

In both questions, professionals considered parasitic gastroenteritis (PGE) to have a high impact while farmers scored this lower.

Farmers and professionals all considered liver fluke, fly strike and sheep scab to be priorities, with fairly equal scorings. Fly strike ranked second for farmer groups in relation to animal welfare, but ranked sixth for professionals. However, it is important to note that professionals perceived the scale of impact to be greater than farmers, scoring at least one point higher.

Caseous lymphadenitis (CLA), Maedi Visna (MV) and emerging vector-borne disease were perceived to have no impact on hill or upland farms. On the contrary, the lowland farmers who selected MV as a priority scored it as highly impactful. These were mostly breeding stock producers or breeding finishers.

Lowland farmers scored CLA and emerging vector-borne disease as having medium impact.

Results in relation to impact on production efficiency are summarised in Table 1.

Table 1. Relative importance of 15 sheep diseases according to sheep farmers and professionals based on production efficiency impact in the flocks they work with or flocks in their locality. Top three are shaded grey.

Disease	Professionals (n=373)			Sheep Farmers								
				Hill (n=155)			Upland (n=249)			Lowland (n=473)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n	Rank	Median	n
CLA	15	3.5	2	13	0	0	13	0	0	14	3	3
Maedi Visna	12	3	4	13	0	0	13	0	1	12	4.5	4
Johne's disease	14	4	2	12	3	2	12	1.5	4	15	1	5
OPA Jaagsiekte	10	3	8	10	3	6	8	3	10	10	3	10
Listeria	13	3	3	11	3.5	2	11	3.5	2	11	3	9
EAE / Enzootic abortion / Chlamydia	7	5	19	7	3.5	8	9	3.5	8	9	3.5	20
Toxoplasmosis	9	5	10	7	3.5	8	10	4	5	8	4	19
Pasteurella	8	3	26	6	3	14	6	3	22	7	3	42
Parasitic gastroenteritis (PGE)	2	5	46	9	3	9	7	3	20	5	4	35
Sheep scab	4	4	39	3	3.5	18	2	4	28	6	4	33
Liver fluke	5	4	37	2	4	19	3	3	36	4	3	47
Fly strike	6	3	48	5	2	23	5	2.5	36	2	3	84
Emerging vector-borne disease (eg Bluetongue, Schmallenberg)	11	5	3	13	0	0	13	0	0	13	3	5
Footrot	1	4	82	1	3	33	1	4	52	1	3	109
CODD	3	4	44	4	4	13	4	4	25	3	4	48

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

4.3 National sheep disease priorities based on perceived impact on production efficiency, market access and industry reputation

The top priority diseases for all groups of sheep farmers and professionals in relation to the impact on production efficiency, market access and industry reputation at a national level were footrot and sheep scab. As with the questions relating to impact at a local level, CODD, liver fluke and fly strike were also perceived to be of national importance.

Again, CLA and emerging vector-borne diseases were considered low priorities across all groupings, as was listeria. MV and Johne's disease were selected by more respondents and scored as more impactful in relation to their effect nationally than locally, particularly among lowland farmers.

Professionals and farmers considered PGE to have medium-high impact on production efficiency but scored the impact on market access and industry reputation lower.

Results in relation to impact on production efficiency are summarised in Table 2.

Table 2. Relative importance of 15 sheep diseases according to sheep farmers and professionals based on national production efficiency impact. Top three are shaded grey.

Disease	Professionals			Sheep Farmers								
	(n=672)			Hill (n=228)			Upland (n=371)			Lowland (n=729)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n	Rank	Median	n
CLA	14	3	9	13	3	2	14	3	4	15	3	6
Maedi Visna	10	4	22	9	4	9	11	4	10	10	3	33
Johne's disease	11	4	19	12	3.5	4	13	3	11	12	3	25
OPA Jaagsiekte	12	3	18	8	4	10	9	3.5	16	11	3.5	22
Listeria	15	2.5	2	13	2	3	15	3	1	14	3	8
EAE / Enzootic abortion / Chlamydia	5	4	68	4	4	18	5	3.5	30	6	4	60
Toxoplasmosis	9	4	23	11	4	7	10	3	17	9	4	39
Pasteurella	7	4	33	9	3	12	8	3	29	8	4	46
Parasitic gastroenteritis (PGE)	2	4	92	4	4	18	7	4	23	7	4	48
Sheep scab	3	4	87	1	4	35	2	4	52	2	4	101
Liver fluke	6	4	66	3	3.5	32	3	4	45	3	4	78
Fly strike	8	3	34	6	3	21	6	3	31	4	4	69
Emerging vector-borne disease (eg Bluetongue, Schmallenberg)	13	3	11	13	2	3	12	4	9	13	4	15
Footrot	1	4	108	2	3	39	1	4	61	1	4	117
CODD	4	4	80	7	4	15	4	4	32	5	4	62

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

4.4 Personal sheep syndrome priorities based on perceived impact on production efficiency and animal welfare

Neonatal lamb disease or mortality (eg infertility, abortion or still birth) ranked high in all groups in both production and animal welfare. There was disparity between professional and farmer impact scores, with professionals scoring this higher than farmers.

Anthelmintic resistance also ranked high across the groups, but with greater perceived impact on welfare than on production. Again, professionals scored the impact higher than farmers.

Reproductive failure ranked high in the question relating to production efficiency, particularly by professionals. The impact on animal welfare was perceived to be much less, with many farmers scoring it as having low impact.

For hill farmers, joint ill was top priority. Although this did not rank as high as some other syndromes for the other groups due to lower number of responses, the impact scores were comparable.



For upland and lowland farmers, mastitis was a top priority. Although this did not rank as high for professionals and hill farmers due to a lower proportion selecting it as a top priority, the impact scores were comparable. Impact on welfare was perceived to be greater than on production efficiency.

While a relatively small proportion of respondents (5-7%) selected involuntary or premature culling of ewes as a priority, impact on production efficiency was scored medium-high.

There were differences in impact scores among respondents for ill-thriven lambs. Overall, professionals scored this higher impact than farmers, and lowland farmers higher than upland and hill farmers.

Photosensitisation was perceived to have no or little impact on production or animal welfare by all groups.

Results in relation to impacts on production efficiency and animal welfare are summarised in Tables 3 and 4 respectively.

Table 3. Relative importance of 12 sheep syndromes according to sheep farmers and professionals, based on production efficiency impact in the flocks they work with or flocks in their locality. Top three are shaded grey.

Syndrome	Professionals			Sheep Farmers								
	(n=392)			Hill (n=122)			Upland (n=208)			Lowland (n=412)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n	Rank	Median	n
Reproductive failure (eg Infertility, abortion or stillbirth)	3	5	49	4	3	14	5	3	22	5	4	31
Neonatal lamb disease or mortality (eg watery mouth, scour)	1	4	72	2	3	15	1	3	33	2	3	58
Joint ill	8	3.5	28	1	3	21	3	3	25	3	3	56
Ill-thriven lambs	4	4	44	9	2	10	6	3	18	7	4	29
Mastitis	7	3	33	5	3	12	2	3	28	1	3	88
Tick borne disease (eg tick borne fever, louping ill)	11	3	6	5	3	12	9	3	12	12	2	5
Photosensitisation	12	0	0	12	2	1	12	5	1	11	1.5	8
Involuntary or premature culling of ewes	6	4	26	8	4	6	7	3	15	8	4	28
Anthelmintic resistance	2	4	66	2	3	15	3	3	25	4	3	48
Flukicide (triclabendazole) resistance	9	4	21	5	4.5	8	8	4	11	9	3	17
Antibiotic resistance	10	4	9	11	3.5	2	11	3.5	4	10	3.5	10
Metabolic disease (eg twin lamb, hypocalcaemia)	5	4	38	10	1.5	6	10	2	14	6	3.5	34

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

Table 4. Relative importance of 12 sheep syndromes according to sheep farmers and professionals, based on animal welfare impact in the flocks they work with or flocks in their locality. Top three are shaded grey.

Syndrome	Professionals			Sheep Farmers								
	(n=392)			Hill (n=123)			Upland (n=207)			Lowland (n=413)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n	Rank	Median	n
Reproductive failure (eg Infertility, abortion or stillbirth)	5	3	49	9	1	14	7	2	21	6	3	31
Neonatal lamb disease or mortality (eg watery mouth, scour)	1	5	71	2	3	15	2	3	33	2	3	59
Joint ill	7	4.5	28	1	4	21	4	3	24	3	3	55
Ill-thriven lambs	3	4	44	8	2	10	9	2	19	7	3	29
Mastitis	6	4	33	5	3	12	1	4	28	1	4	88
Tick borne disease (eg tick borne fever, louping ill)	11	3	6	4	3.5	12	10	3	12	12	3	5
Photosensitisation	12	0	0	11	4	2	12	1	1	11	2	9
Involuntary or premature culling of ewes	9	3	25	7	3.5	6	5	3	15	8	3	27
Anthelmintic resistance	2	4	66	2	3	15	3	3	25	4	3	48
Flukicide (triclabendazole) resistance	8	4	22	6	4	8	6	4	11	9	3	17
Antibiotic resistance	10	4	10	12	3.5	2	11	3	4	10	3	10
Metabolic disease (eg twin lamb, hypocalcaemia)	4	4	38	10	2	6	8	3	14	5	3	35

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

4.5 Regional sheep disease and syndrome priorities based on perceived impact on production efficiency and animal welfare

The perceived impact of diseases on production efficiency and animal welfare were similar for all regions. Footrot was the top priority for all regions except north west England and south east England (ranking a close second in both regions) with respect to both productivity and animal welfare.

CODD scored high in all regions, particularly for its impact on animal welfare. Some regional differences were observed for liver fluke. In general, liver fluke ranked higher in northern/hill/upland/LFA regions (ranking second or third priority) than in lowland regions (ranking seventh to tenth), however impact scores were comparable.

Neonatal lamb disease/mortality and mastitis ranked high in all regions. Scotland LFA responses indicated the impact of flukicide resistance as a priority for them, whereas southern/mid-England and non-LFA regions responses indicated anthelmintic resistance as a priority.

5. Results: Cattle

5.1 Key results

The results of this study found that the exact priority order of the diseases and syndromes varied slightly depending on whether the questions related to impact on production efficiency, animal welfare, market access or industry reputation, whether they were local or national views and whether the respondent was a farmer or professional. However, the top priority diseases and syndromes were consistent.

Top diseases impacting cattle production and welfare in the UK were:

- Digital dermatitis
- BVD
- Johne's disease
- Liver fluke
- Viral pneumonia (PI-3, RSV)

Top syndromes impacting cattle production and welfare in the UK were:

- Lameness
- Reproductive failure
- Neonatal or calf disease
- Mastitis (sub-clinical and acute)
- Bovine respiratory disease (BRD)

Farmer and professional responses for 19 cattle diseases with median impact scores on production efficiency at a local and national level, and 11 cattle syndromes with median impact scores on production efficiency and animal welfare, are presented in Tables 5 to 8. Results of the open questions highlighted several high priority diseases. Most frequently cited were bovine tuberculosis (TB), trace element deficiencies and dystocia.

5.2 Personal and local cattle disease priorities based on perceived impact on production efficiency and animal welfare

Digital dermatitis was considered a priority for both professionals and farmers but particularly for dairy farmers and professionals, who ranked it top and third respectively. The impact of digital dermatitis was considered to be greater on animal welfare than on performance.

Liver fluke was selected by more than double the proportion of beef farmers than dairy farmers or professionals. It ranked as the top priority for beef farmers in relation to productivity, and second in relation to animal welfare.

The impact of viral pneumonia on both production efficiency and animal welfare was perceived as important by professionals, and dairy and beef farmers, with professionals scoring the impact particularly highly.

Johne's disease was also a top three priority for all three groups, particularly in relation to production efficiency. Of note, Cryptosporidia was ranked fourth by professionals and dairy farmers, while ranking ninth for beef farmers. No respondents selected *Psoroptes bovis* (cattle scab), and Q Fever and *Campylobacter fetus* were both low priorities for all groups.

Results in relation to impact on production efficiency are summarised in Table 5.

5. Results: Cattle

Table 5. Relative importance of 19 cattle diseases according to cattle farmers and professionals based on production efficiency impact in the herds they work with or herds in their locality. Top three are shaded grey.

Disease	Professionals (n=555)			Cattle Farmers					
	Rank	Median	n	Dairy (n=316)			Beef (n=814)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n
BVD	4	4	63	4	4	16	4	3	105
Johne's disease	2	4	98	2	3	57	2	3	128
IBR	8	4	23	6	3	19	7	3	47
Leptospirosis	16	3	1	16	3	1	13	3	12
Viral pneumonia (PI-3, RSV)	1	5	92	3	3	41	3	3	126
Mycoplasma bovis	7	4	37	12	3	12	9	4	22
Cryptosporidia	5	4	48	5	3	21	10	3	26
Neospora	10	4	15	6	3	19	12	3	15
Campylobacter fetus	15	5	1	18	0	0	17	3.5	2
Summer mastitis / August bag	13	4	5	10	3	15	8	3	43
E. coli 0157	14	4	4	10	3	15	11	4	13
Parasitic gastroenteritis (PGE)	9	3	21	13	3	3	14	3.5	8
Lungworm	11	3	17	9	3	16	6	3	63
Liver fluke	6	4	39	8	3	17	1	3	134
Psoroptes bovis (cattle scab)	18	0	0	18	0	0	19	0	0
Emerging vector-borne disease (eg Bluetongue, Schmallenberg)	17	2	1	17	2	1	15	3	7
Q Fever	18	0	0	15	4	1	18	3	2
Salmonella Dublin	12	4	6	13	3	3	16	3	5
Digital dermatitis	3	4	84	1	3	59	5	3.5	56

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

5.3 National cattle disease priorities based on perceived impact on production efficiency, market access and industry reputation

In relation to the scale of cattle disease impacts on national production efficiency, market access and industry reputation, Johne's disease and Bovine Viral Diarrhoea (BVD) were very closely ranked one and two in all groups. Professionals' median impact scores were generally higher than farmers' for both diseases.

Viral pneumonia also scored high in all three groups, ranking third in relation to national production efficiency and third or fourth in relation to market access and industry reputation. In questions relating to locality, dairy farmers and professionals still considered digital dermatitis a priority at national level, particularly its impact on industry reputation.

Dairy farmers' median score for impact on industry reputation was high.

Liver fluke was selected by twice the proportion of beef farmers (12%) than dairy farmers (6%) or professionals (6%). However, both professionals and dairy farmers considered the impact on national production efficiency higher than beef farmers, scoring medium-high. Contrary to this, the impact of liver fluke on industry reputation and market access was considered to be much lower (median of medium-low impact, and median of medium impact, respectively).

Although *E.coli* 0157 and *Salmonella Dublin* did

not rank particularly high in any of the questions, respondents who did select them as one of their top three priorities for impact on industry reputation gave them high impact scores; much higher than in other questions. Professionals scored them particularly highly, with median impact scores of high for both. As in the questions relating to personal and local priorities, no respondents selected *Psoroptes bovis* (cattle scab) as a priority at national level. Q Fever and *Campylobacter fetus* were again low priorities for all groups.

Results in relation to impact on production efficiency are summarised in Table 6.

5.4 Personal cattle syndrome priorities based on perceived impact on production efficiency and animal welfare

Lameness was considered the top priority for dairy farmers and professionals in relation to impact on both production efficiency and animal welfare. Particularly high scores were given in relation to animal welfare (median showing high impact). While impact was scored slightly lower by beef farmers (medium), lameness was the second ranked priority for this group as it was selected by a large proportion of beef farmer respondents.

Acute mastitis was considered a high priority by both dairy farmers and professionals, with particularly high scores given for impact on animal welfare. Dairy farmers and professionals both scored subclinical mastitis as medium-high impact on production efficiency.

Reproductive failure (eg infertility, abortion or still birth) was second in the priority list for production efficiency impacts, with medium-high and high impact scores from both farmers and professionals. All three groups scored the impact on animal welfare much lower (median of medium-low impact). (cont. p23)

Table 6. Relative importance of 19 cattle diseases according to cattle farmers and professionals based on national production efficiency impact. Top three are shaded grey.

Disease	Professionals (n=764)			Cattle Farmers					
	Rank	Median	n	Dairy (n=441)			Beef (n=1121)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n
BVD	2	4	125	2	4	65	1	4	191
Johne's disease	1	4	151	1	4	87	2	3	199
IBR	5	4	57	5	3.5	32	5	3	87
Leptospirosis	14	3	11	11	3	13	8	3	45
Viral pneumonia (PI-3, RSV)	3	4	96	3	4	48	3	4	144
Mycoplasma bovis	6	4	45	9	3.5	18	11	4	23
Cryptosporidia	8	4	36	8	3	24	12	3	30
Neospora	12	3	17	10	3	20	10	3	33
Campylobacter fetus	16	3	3	17	2.5	2	17	3	7
Summer mastitis / August bag	16	3	3	14	3	9	13	3	24
E. coli 0157	10	3	23	7	3.5	22	9	3	35
Parasitic gastroenteritis (PGE)	9	4	23	16	4	5	14	3	21
Lungworm	13	4	10	13	3.5	8	7	3	55
Liver fluke	7	4	44	6	4	25	4	3	135
Psoroptes bovis (cattle scab)	19	0	0	18	0	0	19	0	0
Emerging vector-borne disease (eg Bluetongue, Schmallenberg)	15	3	9	15	3.5	6	14	3	21
Q Fever	18	1.5	2	18	0	0	18	2	1
Salmonella Dublin	10	3	23	12	3	10	16	3	15
Digital dermatitis	4	4	86	4	4	47	6	4	55

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

For all groups, neonatal or calf disease (eg scour, navel ill, pneumonia) was considered to have a medium-high to high impact on animal welfare and ranked second. Professionals scored this particularly highly (median showing high impact).

Professionals scored bovine respiratory disease (BRD) as highly impactful on both production efficiency and animal welfare. While median impact scores from both beef and dairy farmers were high, a much larger

proportion of beef farmers than dairy farmers (12% vs 4%) selected BRD as one of their top three most important syndromes in the herds they work with.

Although antibiotic resistance was not ranked highly in either question, the disparity between professionals and farmers in terms of its perceived impact is notable. Professionals who selected antibiotic resistance as one of their top three scored the impact on animal welfare particularly high (median of high impact) while both

farmer groups only scored it a medium-low impact.

Transit or shipping fever ranked lowest across all groups in both questions, being selected by fewer than 1% of respondents.

Results in relation to impacts on production efficiency and animal welfare are summarised in Tables 7 and 8 respectively.

Table 7. Relative importance of 11 cattle syndromes according to cattle farmers and professionals based on production efficiency impact in the herds they work with or herds in their locality. Top three are shaded grey.

Syndromes	Professionals			Cattle Farmers					
	(n=472)			Dairy (n=265)			Beef (n=615)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n
Reproductive failure (eg infertility, abortion or stillbirth)	2	5	73	2	4	54	1	4	109
Neonatal or calf disease (eg scour, navel ill, pneumonia)	4	4	82	3	4	35	3	3	124
Bovine respiratory disease	3	5	67	8	4	11	4	3	76
Acute mastitis	8	4	20	5	4	26	8	3	24
Subclinical mastitis	5	4	41	4	4	34	6	3	31
Transit or shipping fever	11	4	1	11	0	0	11	3	5
Metabolic disease	6	4	40	7	4	14	7	4	20
Lameness	1	4	105	1	4	66	2	3	127
Involuntary or forced culling of breeding stock	7	4	27	6	4	15	5	3	58
Flukicide (triclabendazole) resistance	9	4	8	10	3	3	8	3	24
Antibiotic resistance	10	3.5	8	9	4	7	10	2	17

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

Table 8. Relative importance of 11 cattle syndromes according to farmers and cattle professionals based on animal welfare impact in the herds they work with or herds in their locality. Top three are shaded grey.

Syndromes	Professionals (n=476)			Cattle Farmers					
	Rank	Median	n	Dairy (n=264)			Beef (n=609)		
	Rank	Median	n	Rank	Median	n	Rank	Median	n
Reproductive failure (eg infertility, abortion or stillbirth)	5	2	73	4	2	54	4	2	107
Neonatal or calf disease (eg scour, navel ill, pneumonia)	2	5	83	2	4	35	1	4	124
Bovine respiratory disease	3	5	68	8	4	11	3	4	75
Acute mastitis	7	5	21	3	5	26	6	4	24
Subclinical mastitis	6	3	41	5	3	34	8	2.5	30
Transit or shipping fever	11	4	1	11	0	0	11	3	5
Metabolic disease	4	4	40	6	4	14	7	4	21
Lameness	1	5	106	1	5	65	2	3	125
Involuntary or forced culling of breeding stock	8	3	27	7	3	15	5	2	57
Flukicide (triclabendazole) resistance	10	4	8	10	3	3	9	3	24
Antibiotic resistance	9	5	8	9	2	7	10	2	17

*n is number of impact scores given. Each respondent could score the impact of their top three selected diseases.

5.5 Regional cattle disease and syndrome priorities based on perceived impact on production efficiency and animal welfare

There was close agreement between the different regions for most diseases and syndromes, particularly those ranked highest and those not selected by any respondents.

Of note, digital dermatitis, Johne's disease and viral pneumonia were perceived to be important in all regions. BVD was ranked higher in England than in Scotland, Wales or Northern Ireland. While liver fluke ranked higher in Wales, Scotland LFA and Northern

Ireland than in English regions, impact scores given by respondents in all regions were comparable.

Reproductive failure, neonatal disease, lameness and BRD were ranked high in all regions. There was regional variation observed for acute mastitis with English respondents (particularly in the lower half of the country) scoring higher than Welsh, Scottish or Northern Irish respondents.

6. Discussion

6.1 Comparison of results with other research

6.1.1 CATTLE RESEARCH

BVD was one of the top priorities identified in the RH&W survey, with comparable professional and farmer scores. Animal Health Ireland (AHI) highlighted BVD as a priority, ranking particularly highly in relative importance for beef farmers¹. BVD was also identified as a priority disease for cattle in Skuce et al². Furthermore, it ranked second, after TB, in the 2020 CHAWG report³ for diseases which impact the beef sector economically and as the top investment priority.

Eradicating BVD is a priority of the Wales Animal Health and Welfare Framework Group through Gwaredu BVD⁴, funded by the Welsh Government's Rural Development Programme; over 75% of cattle farms in Wales have been screened so far. In the ADAS report into the impact of controlling endemic cattle diseases⁵, BVD was reported to increase greenhouse gas emissions (GHGs) (most of all diseases reported). Consequently, there is a high potential to reduce GHGs through reducing BVD. Involvement of six key industry organisations in the BVDFree⁶ scheme, working to eliminate BVD from all cattle in England by 2022, also highlights its importance.

Johne's disease was identified as a priority by the RH&W survey, AHI¹, Skuce et al² (listed as paratuberculosis in the AHI report) and CHAWG³. A report from the Fallen Stock Scheme⁷ highlighted

that Johne's disease was commonly diagnosed in the suckler herd, suggesting earlier intervention to improve control was lacking and that herd screening should be encouraged.

IBR was identified as a priority in the study by AHI¹. In the RH&W survey, IBR ranked fifth in relation to both national production efficiency and welfare, with medium to high impact scores. Professionals consistently scored the impact of IBR higher than farmers in RH&W survey, whereas in the AHI¹ study, responses of farmers and experts were in close agreement. In the GHG report compiled by Skuce et al², GHG emissions savings for IBR were considered most cost-effective and feasible in dairy cattle. IBR is also mentioned as a priority in Livestock Health Scotland's strategic goals.

Digital dermatitis was identified as a priority in the RH&W survey, particularly for dairy farmers. Lameness overall was scored highly impactful by both professionals and farmers. While digital dermatitis was not included in the list of diseases presented in the AHI survey¹, lameness was highlighted as a priority. The CHAWG report (2020)³ supported this, with lameness ranked as the top issue for economic impact in dairy herds. In a survey conducted as part of the farm-level interdisciplinary approaches to endemic

livestock disease (FIELD) project⁸, dairy farmers were found to be more concerned about lameness than beef farmers, with the majority perceiving it to be a risk to their income. In the study by Rioja-Lang et al.⁹, which aimed to prioritise farm animal welfare issues using expert consensus, there was strong agreement among cattle experts that poor foot health ranked highly for prevalence, severity and duration.

As well as liver fluke being flagged as a priority for beef farmers in the results of the RH&W survey, the study by AHI¹ found that beef farmers prioritised parasitic conditions generally. In the study by ADAS⁵, liver fluke was found to increase GHG emissions by 10% compared with healthy cattle; along with IBR and Johne's disease, control of liver fluke was identified as one of the key opportunities for GHG abatement in UK cattle.

Reproductive failure, neonatal or calf disease and mastitis were all highlighted as priority syndromes in the RH&W survey results. In the AHI results¹, fertility, udder health/milk quality and calf health were all cited as high priorities. While the exact wording differed, these 'syndromes' cover a range of risk factors and diseases which, although diverse, generate similar signs or production impacts. CHAWG also ranked mastitis as the second most impactful disease for dairy herds economically³.

Both the RH&W survey and AHI survey¹ identified pneumonia as a priority. In the RH&W survey, professionals scored the impact highest, while in the AHI survey, beef farmers scored the impact highest. In the CHAWG report³, pneumonia was fourth in the top-ranked diseases for economic impact to beef herds. This report also showed the biggest increase in vaccine uptake between 2011 and 2019 was for IBR (50%) and calf pneumonia (22%). In cattle, pneumonia is thought to be responsible for a considerable, but unknown, proportion of antibiotic use. Given the focus on the responsible use of antibiotics, it is promising that farmers may have prioritised spend on these vaccines.

Skuce et al² identified Cryptosporidia as a priority disease. In the RH&W survey, the impact of this was scored higher by dairy farmers and professionals than beef farmers. Cryptosporidia was considered to have a greater impact at local level than nationally. In the AHI survey¹, diseases of young calves were grouped but were also highlighted as a priority.



6.1.2 SHEEP RESEARCH

In the results of the RH&W survey, lameness (footrot and CODD) and scab were identified as top priorities both in terms of production and welfare. Skuce et al's top sheep priorities agree with this². Both lameness and sheep scab scored particularly high in relation to animal welfare in both studies. In corroboration, a survey conducted to identify sheep farmers' greatest disease concerns as part of the FIELD project⁸, many of the diseases identified related to lameness. In the study by Rioja-Lang et al⁹, which aimed to prioritise farm animal welfare issues using expert consensus, severity of lameness had high agreement among the most highly ranked welfare issues.

Sheep scab and mastitis were also identified in this study to be priority welfare issues. In RUMA's Targets Task Force Report 2020¹⁰, lameness/footrot was identified as a main cause of antibiotic use in sheep. In terms of production efficiency, Nieuwhof and Bishop (2007)¹¹ concluded that of the diseases studied, the costliest for the British sheep industry are gastro-intestinal parasites, footrot and scab; reductions in the severity or incidence of these could have a large impact on costs of production. The Fallen Stock Scheme project⁷ highlighted that parasitic gastroenteritis (PGE) and pasteurellosis accounted for a significant number of lamb losses, and PGE is consistently the most common Veterinary Investigation Diagnosis Analysis (VIDA) finding. PGE

ranked high in the professional responses of the RH&W survey, while *Pasteurella* ranked mid-table for both professionals and farmers. PGE was considered to be the most cost effective and feasible to control of the diseases in the Skuce et al report on GHGs².

According to the Fallen Stock Scheme project⁷, 'iceberg diseases' (OPA and Johne's disease) were common among adult sheep. One of the strategic goals of Livestock Health Scotland is to promote best practice identification, exclusion and control of iceberg diseases, and to support the development of commercial flocks with defined low risk status as a potential source of low-risk breeding stock. In the RH&W survey, the iceberg diseases were not ranked highly although some respondents considered the impact of them to be medium-high.

In the study by Rioja-Lang et al⁹, mortality and morbidity of youngstock was ranked highly in ruminant livestock, for both the impact on individual suffering and prevalence. The results of the RH&W survey support this, with neonatal lamb disease or mortality highlighted as a top priority, particularly in relation to welfare. Furthermore, one of the priorities identified by SHAWG in its 2020-21 report¹² was improving lamb survival and performance from scanning to sale, which encompasses improvements in neonatal lamb disease or mortality. RUMA's Targets Task Force report

2020¹⁰ also prioritises neonatal lamb disease (chiefly joint ill and watery mouth), pneumonia and enzootic abortion (EAE) as key causes of antibiotic use in sheep. Skuce et al² suggested that emission intensity could be significantly reduced through control measures relating to ewe fertility and lamb mortality.

Reproductive failure encompasses a range of diseases and conditions and, as such, many of the priority diseases mentioned here support the recognition that reproductive failure is highly impactful on both production and welfare. In a survey of the UK veterinary profession to identify common challenges¹³, reproduction conditions were the most frequently mentioned for production animals. In sheep, this included lambing, dystocia, abortion and twin lamb disease, fertility and parturition problems.

The SHAWG report¹² highlighted that disease caused by liver fluke is responsible for considerable economic loss, estimated at £3-5 per infected sheep. These losses are caused by direct production losses, poor reproductive performance and livers rejected at slaughter. Its presence in the priority list identified by the RH&W survey supports this.

Supporting the findings of this survey, anthelmintic resistance studies suggest that the prevalence of anthelmintic resistance (AR) in the UK has continued to increase over the past five years. Recent estimates

put the cost of this at £3.3m/year¹⁴. A priority objective for SHAWG¹² was to promote and encourage responsible use of medicines, including anthelmintics and antimicrobials. It is possible that the development of an online Medicine Hub for cattle and sheep by AHDB could provide more information on medicine use in the sheep sector and help address the impact of anthelmintic resistance.

6.2 Production efficiency vs welfare

As anticipated, diseases were scored differently according to impact on production versus impact on welfare. Respondents working with sheep considered footrot and CODD, fly strike and mastitis to have a greater impact on welfare than production efficiency. In cattle, acute mastitis, lameness and digital dermatitis were considered to have a greater impact on welfare.

6.3 Professional vs farmer

There was some disparity between professional and farmer views. Generally, professionals scored the impact of diseases and syndromes higher than farmers.

These differences of opinion may be a result of vets having a greater understanding of animal physiology, thereby being more informed about the true impact of certain diseases. Vets will visit numerous farms so may have a broader range of experience than farmers, who may only be able to assess the impact of diseases on their own farm.

However, it is also possible that vets are only called out to issues that cannot be dealt with by the farmer, which could influence what is seen as the biggest issue.

For example, fly strike ranked second for sheep farmers in relation to animal welfare, but only ranked sixth for professionals. Farmers generally deal with fly strike themselves and vets are not involved unless in extreme cases. Treatments for fly strike do not need to be bought through a vet, so again, they may be unaware of an issue on farm. Issues like fly strike can cause (misplaced) embarrassment to farmers who may be reluctant to seek veterinary input.

Importantly, cattle professional and farmer responses were notably dissimilar in relation to the impact

of antibiotic resistance on animal welfare, with professionals scoring the impact as high while both farmer groups only scored medium-low impact.

An influencing factor may be that farms which are not testing or screening for diseases are not aware of a problem and so do not have an informed awareness of the impact.

Similarly, if farmers are not collecting or inspecting flock or herd records which highlight impacts on production, they may not notice an impact which would necessitate further investigation (eg testing or screening). For example, lowland farmers who selected MV as a priority scored it as highly impactful, particularly from a national perspective. The majority of these were breeding stock producers or breeding finishers and could have been pedigree breeders who would be unable to export breeding animals without screening for MV accreditation.

Sheep being of lower value than cattle, vets are less likely to be called out for an individual animal. This could explain why the differences between professional and farmer opinion are more pronounced for sheep than cattle.

6.4 System differences

With cattle farmers in particular, some variations in priorities between enterprise type were observed. One of the most pronounced examples of this was liver fluke, which was considered a higher priority for beef farmers than dairy farmers. This is perhaps not surprising as beef cattle could be more likely to spend more time grazing outdoors on infested pastures than dairy cattle. It would be interesting to understand the differences in grazing access on farms which responded to this question with high versus low impact scores.

In contrast, dairy farmers placed a higher priority on digital dermatitis. This was further corroborated in responses relating to syndromes. While lameness was considered a top priority for all respondents, dairy farmers and professionals scored the impact of such on both production efficiency and welfare particularly high. This is expected as digital dermatitis is a common problem for many dairy herds; even if it is not at the forefront of all lameness problems on farm, it is often lurking in the background. It can also affect herd performance, causing reduced milk yields, infertility and an increased susceptibility to other lameness causes.

The most notable difference in priorities between hill, upland or lowland sheep farmers was observed for flukicide (triclabendazole) resistance. Hill and upland farmers scored flukicide resistance higher than

lowland farmers (median of medium-high or just above for hill and upland versus medium for lowland). This trend was also observed in the regional data, with farmers in Scotland LFA, Wales LFA, NI and north-west England scoring higher than those in non-LFAs and mid- and southern England.

The National Animal Disease Information Service (NADIS) provisional autumn fluke forecast for 2020 predicted high risk in southern parts of Scotland, north Wales, north-east England and Northern Ireland. It forecast medium risk in northern Scotland, south Wales and south east England and low risk everywhere else. This illustrates that liver fluke is a major problem where hill and upland farms are located. In hill and upland systems, flocks may only be gathered a few times a year, and moors and upland fields can be ideal habitats for the mud snail host, meaning control is difficult. The most commonly used flukicide is triclabendazole because of its activity against immature fluke. Unfortunately, overuse has led to suspected development of resistance in parts of the UK.

Lowland farmers scored the impact of metabolic disease higher than hill and upland farmers, particularly with respect to production efficiency. However, there was no regional correlation. Metabolic diseases can have similar clinical signs yet have different causes and require different treatments.

Many metabolic disorders occur because of inadequate ewe nutrition around late pregnancy and in early lactation. It is possible that lowland farms lambing inside experience metabolic disorders more than those lambing outside due to introducing feed when ewes are housed. Furthermore, in some grazing systems, where ewes are heavily stocked, competition for feed may be too high and ewes become inadequately fed. Ewes with multiple lambs are often more susceptible to metabolic diseases than single-bearing ewes, and lowland breeds often raise multiples.

6.5 Limitations

6.5.1 RESPONDENT INTERPRETATION

When observing the results of this study, there should be some consideration around how farmers and professionals interpreted the disease and syndrome options presented.

For the sheep sector in particular, there may have been a tendency to group lameness causes (except CODD) as footrot, particularly as lameness was not an option in the syndromes list. Inclusion of footrot and CODD in the diseases list intended to capture opinion on infectious causes of lameness.

However, an important infectious cause of sheep lameness is interdigital dermatitis (scald) and this was not included in the list. While our understanding of the link between footrot and interdigital dermatitis (caused by the same bacteria) has progressed, farmers still have a tendency to distinguish the two, with infection limited to the interdigital space referred to as interdigital dermatitis and the underrunning of the hoof described as footrot. Furthermore, the omission of lameness from the syndromes list means that opinion on non-infectious causes of lameness may not have been captured in this survey.

As referenced in the survey itself, some of the syndromes presented for consideration are linked with stages in the production cycle. It may be that some respondents also considered them linked in other ways. For example:

- Joint ill and ill-thriven lambs may be interlinked with, and in fact cause or contribute to, body condition score, colostrum quality and quantity, neonatal lamb disease or mortality.
- With respect to metabolic disease, any disease or disorder that prevents the ewe from feeding adequately (eg lameness, teeth issues, internal parasites) could cause a metabolic disease. There are numerous metabolic disorders which, although they have similar signs, can have different causes. Grouping these means we lack insight into the specifics.
- Several of the syndromes included in the survey list could lead to involuntary or forced culling of breeding stock, particularly mastitis or reproductive failure. Therefore, responses for these could be linked.
- Triclabendazole is an anthelmintic so could also fall into the “anthelmintic resistance” category and respondents could have selected both as a result. This could also be linked to ram longevity and the fact that rams are not often included in routine flock medications.¹⁵
- From a disease perspective, *Mycoplasma bovis* causes several diseases in cattle including respiratory disease and ear infections (otitis media) in calves, and can cause arthritis, mastitis and pneumonia in older animals. Therefore, responses could encompass opinions on these.
- MV is a sheep disease which is known to lead to mastitis so it is possible that there could be some correlation in responses.
- Interpretation of the meaning of ‘scale of impact’ could have differed between respondents, with some ratings indicating the amount of distress the condition causes an animal (ie the impact on the animal directly) while others may have been scoring the prevalence of the condition.
- Perceptions of vaccines could have influenced responses to disease impacts. Diseases which have available preventative vaccines may not have been considered to have a high impact on production or welfare, as good management could prevent occurrence.
- Another important aspect to consider is that recency (the last thing on one’s mind) may have impacted survey responses. Recently reading or seeing a campaign about something could influence responses. Furthermore, prolificacy of many syndromes can vary greatly from season-to-season and year-to-year, so timing of this survey could have motivated some responses.

6.5.2 OMISSIONS

Identified omissions from the disease and syndromes list include the following:

- A large proportion of free text responses identified that TB was missing from the list of diseases. While bovine TB obviously presents overwhelming pressure on many producers, the survey deliberately excluded TB as it was seeking views on other diseases which reduce production efficiency in the sheep and cattle sectors. The omission of TB, however, may have been a distraction for some who are particularly affected, so TB should still be taken into account in strategy development.
- There are five iceberg diseases of sheep: CLA, MV, Johne's, OPA and Border disease. While the first four of these were included in the survey, Border disease was not. As well as the impact on production (poor scanning rates, barren ewes, abortion, still births, birth of small, weak lambs), the clinical conditions caused by Border disease are a real welfare problem. Therefore, Border disease should be considered in both future studies and future interventions.
- Trace-element/mineral deficiencies were regularly mentioned in the open questions as having high impacts on production. As nutritional deficiencies often lead to some of the syndromes listed (eg ill-thriven lambs and reproductive failure), it could be that omission of this in the survey resulted in incorporation of the resulting conditions into other responses.
- Lameness was included in the cattle syndromes list but not the sheep syndromes list. As mentioned previously, interdigital dermatitis was also omitted.
- Although not a disease, dystocia has a high impact on cattle welfare and was mentioned several times in the open questions.

6.6 Further research

It would be useful to ask respondents to elaborate on reasons for their top three selected diseases and syndromes. This may reveal more about how they rate the seriousness of health challenges and inter-relationships between diseases and syndromes.



7. Conclusions

As one of the few surveys conducted with the 'grassroots' of the livestock farming sectors, encompassing both professionals and farmers, this has provided a large amount of data for analysis. The results will be a reference point to help justify future disease control initiatives on farm and at regional and national levels.

The large response was really positive, and has captured a good mix of opinion from both farmers and professionals – possibly indicative of increased recognition of the importance of managing diseases to improve productivity, welfare and reputation.

The results show some similarities with expert views from other studies – but also some interesting differences. The subtle differences in view between farmers and professionals is interesting and more manifest in the sheep responses where vet involvement may be less frequent. While farmers are aware of issues which don't require a vet visit, vets may have a wider overview across different regions.

In the cattle results it is welcome confirmation to see digital dermatitis and lameness as the top issues, reflecting lameness's importance from both a welfare and production perspective. Similarly, pneumonia, bovine respiratory disease and neonatal calf disease all feature in the top five, reflecting the importance of youngstock disease in all sectors.

The fact that key infectious diseases BVD and Johne's disease rank highly, reflects their importance and recognition by farmers and vets. This justifies the control programmes available and should add impetus to a national control and eradication programme for England to complement what is happening in other devolved nations.

The relative importance of liver fluke infection for the beef suckler sector should drive further research and knowledge exchange to balance the best control strategies with the impact on productivity, avoiding flukicide resistance and the impact of anthelmintics on the environment.

Free text responses to the survey are particularly interesting. For those that mentioned TB, there are new initiatives in place to tackle it and the BCVA has positioned itself for future control, management and vet training.

The next steps are perhaps the most crucial thing to get right, to signpost well-established initiatives and identify areas where further co-ordinated effort could make a significant difference.

In terms of the sheep results, it is interesting that the top syndrome is neonatal lamb disease/mortality, yet none of the neonatal diseases are in the top six diseases. Similarly, if footrot and CODD are the top

diseases, lameness may be an important omission from the range of options offered under syndromes. CODD is likely to be under-diagnosed and the iceberg diseases unrecognised.

The responses may reflect health problems that farmers see (footrot and lameness, scab and PGE) rather than diseases that are difficult to see yet cause sub-clinical problems like MV, Johne's disease, OPA and CLA – as well as Border disease, which was not included.

However, some did flag CLA, OPA and MV, which appear to be more important in the lowlands. These farmers are mainly recipients of upland crossbred sheep. This suggests that buyers are starting to ask for disease status which may make suppliers nervous. This possibly signifies the need for a scheme or process to support farmers who are prepared to screen for diseases.

Overall, we do have solutions to many of the common diseases that are causing problems. Often the solutions are known but putting them in place on farm creates challenges. This will be an important part of the next steps, and the interventions agreed and implemented could provide a significant benefit to the proposed Animal Health and Welfare Pathway in England.

8. Next steps

The outcomes of this survey will be taken forward by the RH&W steering group into a workshop in summer 2021. The intention is to include not only specialist expertise but representatives of the farming and farm vet community as well in order to examine ways in which a step-change in progress can be achieved. The challenge is to deliver a new operating environment based on farm level priorities, but also to identify effective interventions which:

1. Are relevant to range of producers
2. Deliver cost or time benefit
3. Win the buy-in of producers.

The workshop findings and accompanying action plan will be published following the workshop.

A range of options exist, and different mitigating factors will dictate which is the most appropriate of a range of possible approaches, such as:

- Eradication.
- Targeted risk management.
- Monitoring systems which trigger an intervention when a disease or condition breaks a threshold (a range of interventions could exist depending on other factors).
- Maintaining disease freedom or adopting vet-approved control and/or vaccine programme.
- From a disease perspective, *Mycoplasma bovis* causes several diseases in cattle including respiratory disease and ear infections (otitis media) in calves, and can cause arthritis, mastitis and pneumonia in older animals. Therefore, responses could encompass opinions on these.
- System change to reduce challenge.
- Health declarations for breeding stock.
- National core vaccine programme.

National or regional approaches may add value by:

- Reducing risk of health status breakdowns – for example by reducing risk of biosecurity failures and the associated costs of failure.
- Underpinning on-farm livestock performance with elevated health status – for example through improving Key Performance Indicators.
- Supporting low risk trading of livestock.
- Contributing to solutions for other industry challenges – such as animal welfare issues, antimicrobial resistance, biosecurity, and net zero targets.
- Work to ensure incentives for disease screening and monitoring – support should be considered where unexpected results are found.
- Initiatives to support veterinary health and welfare reviews on farm.
- Significant work needs to be done to overcome difficulties in implementing known solutions on farm – in so many cases solutions are available but barriers to uptake continue.
- Much of the work that has been done may need to be reviewed in light of climate change and newly emerging ‘regenerative farming’ approaches that may be an outcome of current policy development.

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