

Sheep farmers' attitudes to farm inspections and the role of sanctions and rewards as motivation to reduce the prevalence of lameness

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Abstract

The Welfare of Farmed Animals (England) Regulations (2007) make it an offence to allow unnecessary suffering to animals, highlighting that farmers have a duty of care for their livestock. Despite this, the current global mean prevalence of lameness in sheep in England is 5%; ie ~750,000 lame adult sheep at any time. To investigate farmers' attitudes to sanctions and rewards as drivers to reduce the prevalence of lameness in sheep, farmers' attitudes to external inspections, acceptable prevalence of lameness and attitudes on outcomes from inspections were investigated using a self-administered questionnaire. A total of 43/102 convenience-selected English sheep farmers responded to the questionnaire. Their median flock size was 500 ewes with a geometric mean prevalence of lameness of 2.8%. Few farmers selected correct descriptions of the legislation for treatment and transport of lame sheep. Participants considered 5–7.5% prevalence of lameness acceptable and were least tolerant of farmers who rarely treated lameness and most tolerant of farmers experiencing an incident out of their control, eg disease outbreak. Participants consider sanctions and rewards would help to control lameness on sheep farms in England. Sanctions (prosecution, reduction in payment from the single [basic] payment scheme or suspension from a farm assurance scheme) were considered 'fair' when lameness was $\geq 10\%$ and rewards 'fair' when lameness was $\leq 2\%$. If these farmers' attitudes are applied to 1,300 randomly selected flocks with a mean prevalence of lameness of 3.5%, 24.6% of flocks that had $\geq 10\%$ lameness would be sanctioned and 32.5% of flocks that had $\leq 2\%$ lameness would be rewarded.

Keywords: animal welfare, attitudes, lameness, legislation, rewards, sanctions

Introduction

The control of lameness is covered by legislation and codes of practice on the welfare of livestock. The Welfare of Farmed Animals (England) Regulations (2007) came into force on 1st October 2007 under the Animal Welfare Act of 2006. The Act sets down minimum standards for the protection of all farmed livestock, making it an offence to cause or allow unnecessary suffering to any animal. This, therefore, introduced a duty of care for all animals, setting out minimum standards for accommodation, feeding and watering, maintenance of equipment used with livestock, and regularity of inspection. This is to ensure that animals are in a state of good well-being. The Welfare of Farmed Animals (England) Regulation 4 (2)(d) requires that a person responsible for a farmed animal "must have regard to its physiological and ethological needs in accordance with good practice and scientific knowledge." Sheep farmers must also comply with the Council Regulation (EC) No 1/2005 on the protection of animals during transport and related operations. In addition, the Welfare of Animals (Transport) (England) Order (2006) bans the transport of

unfit animals, including those that are injured or present physiological weaknesses or pathological processes, and those unable to move independently without pain. The legislation is written to cover all farmed animals or all animals, respectively, so the wording is generic and the style of language is complex.

Other than legislation, codes on welfare are available that are species-specific, these provide guidance on how to care for animals and how to comply with the Act and any regulations issued under the Act. Breaching a code, in itself, is not an offence but could be used by a court to establish or negate liability. Approximately 1% of sheep farms in Great Britain (GB) are inspected annually by the Animal and Plant Health Agency (APHA) to investigate compliance with welfare legislation and code (KilBride *et al* 2012; Clark *et al* 2016).

In addition to the above, there are statutory management requirements (SMRs) which farmers must comply with under cross-compliance with the EU to qualify for full payment under the direct payments schemes. These offer a layer of income support to farmers as well as targeting specific types of beneficiaries funded in the EU; there are a

number of specified SMRs to which sheep farmers must adhere. Of particular importance is SMR 13 (previously SMR 18) (Defra 2015) which requires farmers to thoroughly inspect their livestock as often as necessary to avoid suffering, and to ensure that they are looked after by staff who have the correct skills and knowledge. Approximately 1% of claimant farms in GB are inspected annually to investigate compliance with SMRs (Clark *et al* 2016).

Farm assurance schemes were developed to ensure that producers comply with certain standards of food safety and animal welfare in the UK as a result of well-publicised food scares during the 1980s and 1990s (Knowles *et al* 2007), which led to increased pressure on the agricultural industry to improve its practices, and to the Food Safety Act of 1990. Different quality assurance schemes (QAS) weight standards differently (Wood *et al* 1998; Morris & Young 2000), for example, the Freedom Food scheme set up by the Royal Society for the Prevention of Cruelty to Animals (RSPCA) in 1994 emphasises animal welfare (RSPCA 2013a). Other schemes such as Red Tractor are overseen by Assured Food Standards (AFS) and carry out independent inspections to confirm businesses are meeting standards on food safety, animal welfare and the environment. In contrast to 1% of farms inspected, all farms that are members of these voluntary, private schemes are inspected at 12–24-month intervals (Clark *et al* 2016).

Despite legislation, regulation, codes of practice and inspections for all aspects of animal welfare, lameness in sheep is endemic in GB where most sheep farms in England have some lame sheep. To comply with legislation, where every animals' welfare is of concern and Farm Animal Welfare Committee (FAWC 2011) ideal, all lame sheep would be treated and in recovery. Lameness in sheep is a significant welfare concern for farmers and veterinarians (Goddard *et al* 2006; FAWC 2011). Lame sheep are in pain and, if left untreated, develop hyperalgesia (Ley *et al* 1989; Fitzpatrick *et al* 2006), lose body condition and are less productive (Wassink *et al* 2010). Many sheep farmers do not treat individual sheep the day they become lame (Kaler & Green 2008a) and interpretation of the legislation is unclear, however, 'intention to treat', eg if a farmer demonstrates a routine of treating sheep within three days of becoming lame, fits with the evidence for best practice (Wassink *et al* 2010).

Sheep farmers are able to estimate the prevalence of lameness in their flock reliably (King & Green 2011); with > 90% farmers considering sheep lame with locomotion score 2 or above (Kaler *et al* 2009). In 2004, 10.4% of sheep in English flocks were lame at any one time (Kaler & Green 2008b). In 2011, the FAWC published a recommendation that "the prevalence of lameness in flocks farmed in Great Britain should be reduced to 5% or less by 2016 as an interim target, and to 2% or less, (which is already possible with best practice [Wassink *et al* 2010]) by 2021" (FAWC 2011). There is a wealth of evidence that avoiding routine foot-trimming (Wassink *et al* 2003; Kaler & Green 2009; Winter *et al* 2015) and early and accurate diagnosis of the cause of lameness, followed by the correct treatment leads to rapid recovery (Kaler & Green 2008a; Kaler *et al* 2010; Dickins *et al* 2016).

This reduces the prevalence of lameness (Wassink *et al* 2010), prevents loss of body condition, and so reduces unnecessary suffering (for a summary, see Green *et al* 2012).

In 2013, 1,300/4,000 English sheep farmers, selected through stratified random sampling of flocks with > 200 ewes responded to a questionnaire. From this, it was estimated that the global mean prevalence of lameness had fallen from 10.4 to 5% (Winter *et al* 2015). The geometric mean flock prevalence of lameness was 3.5% and, again, a lower prevalence of lameness within respondents was associated with rapid and correct treatment of lame sheep and avoiding foot-trimming (Winter *et al* 2015). These practices are defined as 'current best practice' (O'Kane *et al* 2017) to minimise lameness in sheep.

A reduction in national average lameness to 5% is an improvement from 10.4% in 2004 and, whilst on course to meet FAWC's 2016 target, it is still higher than the proposed target of 2% by 2021. It is possible that a further reduction in the prevalence of lameness might be possible through legislation. Enforceable legislation from a central authority is known to be a powerful mechanism to encourage compliance and co-operation (Gurek *et al* 2006; Traulsen *et al* 2012) even if that sanction is not always applied.

There are insufficient resources to apply legislation across all farms in England and farmers view the current systems of inspection as 'unfair' if they are caught in breach of legislation. Since inspecting farms is resource intensive, Government would prefer farmers to self-regulate (Defra 2014). It is possible that self-regulation could be done by farm assurance schemes with sanctions for high percentages of lame sheep or rewards for low percentages of lame sheep or both. There is also a large literature showing that people co-operate when they can be sanctioned by peers (Traulsen *et al* 2012), however, rewarding good practice also results in compliance (Balliet *et al* 2011).

In this paper, we investigate the role of all external inspections for compliance with legislation, codes of practice and private schemes as well as farmers' attitudes about rewards and sanctions as motivators to control lameness in their flock and in the national sheep industry in order to evaluate whether, and how, external inspections might be used to further reduce the prevalence of lameness in sheep. Questions of interest are when do farmers think that sanctions or rewards should be used? Do farmers view these options as fair and viable? Two key concepts with respect to fairness and viability are: (i) acceptable risk (Fischhoff *et al* 1978; Freeman & Bass 1992; Dowling & Staelin 1994); and (ii) legitimisation. One aspect of acceptable risk refers to the level of risk people are willing to tolerate or indulge (Dowling & Staelin 1994). In the context of lameness, this would equate to the prevalence of lameness in a flock that farmers consider the acceptable upper limit. Legitimation here refers to legitimising the behaviour due to external factors (Lotem *et al* 1999). For example, if sheep are lame due to no fault of the farmer, then this should mitigate against sanctions (Ferguson *et al* 2012). It should only be fair and viable to sanction a farmer whose prevalence of lameness exceeds the acceptable upper limit when there are no legitimate means to mitigate against the sanction. We used these basic ideas to develop the scenarios explained below.

Materials and methods

Ethical approval for this study was granted by the University of Warwick, UK, human ethical review committee, BRSEC. Throughout the paper, participant is used to refer to a farmer who responded to this questionnaire, whilst farmer is the general grouping of sheep farmers in England.

Questionnaire design and administration

Consensus methods were used to derive categories of risk; these have been used commonly elsewhere, eg linked to health and climate change (Johnson 2003; Blaser & Cornuz 2015). Experts in lameness in sheep, the sheep industry, legislation and code and health psychology from the Universities of Warwick and Nottingham, designed a 12-page questionnaire to capture data from participants on their membership of farm assurance and organic certification schemes (Table 1), their management and treatment of lameness, the period prevalence of lameness between July 2013 and June 2014, personal and flock descriptors and external inspections of their farms between January 2011 and December 2014 (Table 2).

One section of the questionnaire was designed to investigate knowledge of legislation in England regarding lameness in sheep. In this section, participants were asked to select one statement which best described their understanding of the current law relating to the care of lame sheep on English farms and the transport of lame sheep in England. Participants were then asked to rate their confidence in their selected statement (Table 3). Another section requested participants' attitudes to external inspections of their flock and were asked to respond to four statements using a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Statements included 'there is currently too much external inspection of animals in my flock' and 'external inspections to check animal welfare in my flock waste my time' (Table 4).

To investigate attitudes of theoretical inspections specifically for lameness, four cut-off percentages of lameness were defined: 2% (FAWC recommended target prevalence achievable with current evidence [FAWC 2011]), 5% (current global mean prevalence [Winter *et al* 2015]), 10% (global mean prevalence of lameness in 2004) and 25% (above the 75th percentile of prevalence of lameness (Winter *et al* 2015)). Participants were asked which prevalence of lameness they perceived to be the upper acceptable limit (theme 1) and at what prevalence of lameness it was fair to sanction farmers (theme 2) in the four scenarios (A–D) following an inspection by an outside body: A) a farmer who rarely treats lame sheep; B) a farmer who has managed lame sheep the same way for over 20 years; C) a farmer who uses best practice (O'Kane *et al* 2017) to manage lameness; and D) where the prevalence of lameness has increased rapidly in the past few months despite seeking and following veterinarian's advice. In theme 1, participants were asked to select a fair prevalence of lameness for each scenario. In theme 2, participants were asked to select by prevalence of lameness, and scenarios A–D, what they considered the fairest outcome from the inspection. The possible outcomes were prosecution, reduction in single payment (the EU subsidy payment to sheep farms), suspension of farm assurance status, no action, able to sell stock to

Table 1 Number and percentage of 43 English sheep farmers by membership of voluntary assurance schemes by the geometric mean (GM) (95% CI) average flock lameness between July 2013 and June 2014.

	N	%	GM (95% CI)
<i>Member of farm assurance or organic certification scheme</i>			
Yes	35	81.4	2.73 (2.10–3.54)
No	8	18.6	3.37 (2.23–5.10)
<i>Scheme</i>			
Red Tractor	31	72.1	2.68 (2.05–3.50)
Freedom Food	1	2.3	1.5*
Organic Certification	3	7.0	4.58 (0.49–43.20)
Other [†]	3	7.0	2.52 (0.93–6.81)
Did not answer	9	20.9	2.95 (1.84–4.73)
<i>Member of a supermarket supply group</i>			
Yes	5	11.6	2.19 (1.04–4.61)
No	38	88.4	2.95 (2.32–3.75)
If yes, specify [‡]			
<i>Member of any other selling group</i>			
Yes	0	0	–
No	42	97.7	2.82 (2.25–3.53)
Did not answer	1	2.3	4*
<i>Claimant under basic payment scheme (BPS)</i>			
Yes	42	97.67	2.84 (2.27–3.56)
No	1	2.33	3*

[†] Farm Assured British Beef and Lamb (FABBL);

[‡] Four farmers are a member of Sainsbury's supermarket supply group and one farmer at Waitrose;

* 95% CI not calculated for small group sizes.

specialist suppliers, gain a bonus on single payment and, extra, payment per kg of lamb sold. Results from theme 1 indicate farmers' acceptable risk and theme 2, the legitimised prevalence of lameness above which it would be fair to intervene: if farmers are sensitive to mitigating circumstances then they should select a higher acceptable prevalence of lameness before it is fair to sanction when there is a legitimisation for the lameness prevalence than where there is not.

In theme 3, three situations were presented to investigate the attitudes of participants on sanctions and rewards following an inspection. The situations were: i) a law is introduced that sets a legal cut-off for the maximum prevalence of lameness, farmers with prevalence above this maximum level would be breaking the law, every flock is inspected every year to check for compliance; ii) a penalty is introduced so that if lameness is above a maximum level when inspected by the Rural

Table 2 Number and percentage of 43 English sheep farmers by number of inspections per year between January 2011 and December 2014, inspector and geometric mean (95% CI) flock prevalence of lameness between July 2013 and June 2014.

	N	%	GM (95% CI)
<i>Sheep enterprise inspected between January 2011 and December 2014</i>			
Yes	33	76.74	2.83 (2.20–3.65)
No	8	18.60	2.47 (1.49–4.10)
Do not know	1	2.33	2*
Did not answer	1	2.33	12*
<i>Number of inspections between January 2011 and December 2012</i>			
No inspections	14	32.6	–
Inspected once	21	48.8	–
Inspected twice	5	11.6	–
Inspected more than twice	3	7.0	–
<i>Number of inspections between January 2012 and December 2013</i>			
No inspections	15	34.9	–
Inspected once	16	37.2	–
Inspected twice	9	20.9	–
Inspected more than twice	3	7.0	–
<i>Number of inspections between January 2013 and December 2014</i>			
No inspections	15	34.9	2.95 (2.30–3.79)
Inspected once	17	39.5	2.84 (1.86–4.33)
Inspected twice	9	20.9	3.22 (1.68–6.14)
Inspected more than twice	2	4.7	1.26*
<i>Inspections January 2011 and December 2012 by</i>			
Animal Health/APHA veterinarian	2	4.7	–
Local authority	2	4.7	–
Trading standards	6	14.0	–
Farm assurance	26	60.5	–
Other [†]	4	9.3	–
Did not answer	14	32.6	–
<i>Inspections January 2012 and December 2013 by</i>			
Animal Health/APHA veterinarian	3	7.0	–
Local authority	1	2.3	–
Trading standards	11	25.6	–
Farm assurance	24	55.8	–
Other [‡]	5	11.6	–
Did not answer	15	34.9	–
<i>Inspections January 2013 and December 2014 by</i>			
Animal Health/APHA veterinarian	2	4.7	1.41*
Local authority	4	9.3	3.87 (1.15–13.04)
Trading standards	7	16.3	3.02 (1.27–7.21)
Farm assurance	27	62.8	2.69 (1.95–3.72)
Other [§]	2	4.7	1.79*
Did not answer	15	34.9	2.95 (2.30–3.79)

[†] One farmer was inspected by cross-compliance for SFP, one farmer was inspected by 'our veterinarian', one farmer inspected by Organic and one other farmer by RPA during January 2011 and December 2012;

[‡] One farmer was inspected by cross-compliance for SFP, two farmers inspected by private/our veterinarian, one farmer inspected by Defra, one farmer by Organic and the other farmer inspected by RPA during January 2012 and December 2013;

[§] One farmer inspected by 'our veterinarian' and the other farmer inspected by Organic during January 2013 and December 2014; '-' data not collected for these years; * 95% CI not calculated with small group sizes.

Table 3 Number and percentage of participants' understanding of current law regarding care and transport of lame sheep on English farms and confidence in selected statement.

	Confidence in selected response		
	Very confident	Fairly confident	Not confident
<i>Statements relating to the care of lame sheep on English farms (n = 31)</i>			
It is illegal to have lame sheep on a farm	0	0	1
It is illegal to have untreated lame sheep on a farm	1	2	0
It is illegal to have untreated lame sheep on a farm without evidence of intention to treat	2	8 (19%)	1
There are no laws that relate to treatment of lame sheep on a farm	3	9 (21%)	1
Do not know or other [†]	0	2	1
<i>Statements regarding transport of lame sheep on English farms (n = 32)</i>			
It is illegal to transport sheep that are unable to move independently without pain or walk unassisted to any destination	9 (21%)	7 (16%)	2
It is illegal to transport sheep that are unable to move independently without pain or walk unassisted unless going straight to slaughter	5 (12%)	3	3
There are no laws relating to transport of lame sheep on the farm	0	1	0
Do not know or other ^{‡§}	1	1	0

[†] One farmer specified that it is illegal to cause unnecessary pain and suffering;

[‡] One farmer specified that it is illegal to maltreat animals. This farmer was very confident in their answer;

[§] One farmer specified as point two (that it is illegal to transport sheep that are unable to move independently without pain or to walk unassisted unless going straight to slaughter) but requires appropriate certificate for slaughter. This farmer was fairly confident in their answer.

Table 4 Number and (percentage) of participants by attitude to animal welfare inspections for lameness in their flock by the geometric mean prevalence and (95% CI) for lameness in ewes between July 2013 and June 2014.

Statement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I welcome inspection to check compliance with animal welfare legislation (n = 38)	2 (1.41, 0.02–115.6)	4 (4.5, 3.6–5.5)	15 (39.5%) (2.7, 2.0–3.7)	15 (39.5%) (3.0, 1.8–4.9)	2 (2.1, 0.03–173.4)
External inspections to check animal welfare wastes my time (n = 38)	1 (2, –)	12 (31.6%) (2.9, 1.5–5.6)	11 (28.9%) (2.6, 1.7–4.0)	14 (36.8%) (3.0, 2.3–3.9)	0
External inspections are important in maintaining animal welfare standards (n = 39)	1 (4, –)	15 (38.5%) (3.1, 2.3–4.2)	10 (25.6%) (2.2, 1.6–3.2)	12 (30.8%) (2.9, 1.5–5.5)	1 (3, –)
There is too much external inspection of animals in my flock (n = 39)	0	9 (23.1%) (1.9, 0.9–4.1)	25 (64.1%) (3.0, 2.4–3.9)	4 (4.2, 2.8–6.1)	1 (3, –)

Payments Agency, rural payment income would be reduced; and iii) if farmers were able to maintain lameness in their flock below a certain prevalence, they were able to sell under a new 'Assured Sound Sheep' trademark. This gives an extra payment per kg of lamb sold. For each situation, farmers selected the maximum upper prevalence of lameness and whether the proposed situation would be an effective way to reduce the prevalence of lameness on sheep farms in England and whether it would impact their business negatively or positively. Theme 3 assessed farmers' attitudes on the effectiveness of rewards and sanctions in particular contexts to differentiate fair from effective.

Most questions were closed or semi-closed and some questions had an 'other' option allowing for free text. The questionnaire was read and commented on by all members of research groups at both universities. Finally, the questionnaire was pilot-tested on five sheep farmers in England (equivalent to 5% of the target sample) to estimate a realistic time-frame for the completion of the questionnaire and to check farmers' understanding of the questionnaire using a feedback form; two farmers responded. They completed the questionnaire correctly and indicated that it was logical and that they understood the questions; no changes were therefore made.

Recruitment of participants

In 2011, 449/972 sheep farmers selected using stratified random sampling based on county and flock size from 18,000 members of the AHDB Better Returns programme participated in a University of Warwick study (King 2013; K Brian, personal communication 2016). The mean global period prevalence of lameness was 5.6%. A total of 102/449 farmers (global mean period prevalence of lameness of 4%) had agreed to participate in further research and this convenience-selected group were invited to take part in the current study. Questionnaire packs containing a cover letter, the questionnaire and a pre-paid return envelope were sent to farmers in December 2014. Reminder letters were sent in January 2015, and a second questionnaire pack was sent to those who had not returned the questionnaire by February 2015. Thank you letters were sent on return of questionnaires. Each questionnaire returned was allocated a unique number and sent to an external agency (Wyman Dillon Ltd, UK) for double data entry. The data received back were stored in Microsoft Excel®, cleaned manually and checked for consistency with the raw data. Where answers were illogical/inconsistent they were excluded from statistical analyses.

Statistical analysis

Summary statistics of central tendency and dispersion were made for each variable in Stata/SE 13.1 (StataCorp 2013). The geometric mean (GM) lameness and 95% confidence intervals (CI) and the median and range of flock sizes were estimated. Graphs were made to summarise data on the acceptable prevalence of lameness by plotting scenarios by 2, 5, 10 and 25% lameness and whether participants ranked this as acceptable or unacceptable.

Responses from participants on cut-off levels for sanctions and rewards were compared with the distribution of lameness reported in a 2013 survey of 1,300 randomly selected sheep farmers in England (Winter *et al* 2015) to estimate the percentage of farmers in each category that would be sanctioned and rewarded.

Results

A total of 43/102 (42%) farmers returned the questionnaire; however, not all farmers answered all questions. There were 40 male and one female respondents. Two participants were 26–35 years old, eleven were 36–45, 13 were 46–55, ten were 56–65 and five were > 65 years old. The flock size ranged from 28 to 1,400 ewes (median 500). Seventy-two percent of participants were members of the Red Tractor scheme (Table 1); 98% claimed rural payments subsidy; five were members of a retailer scheme but no one was a member of a selling group. Between January 2011 and December 2014, 33 participants' farms were inspected, most for farm assurance. The number of external inspections per farm ranged from 1 to 9 (Table 2).

Prevalence of lameness and management of ewes with foot-rot (July 2013–June 2014)

The GM prevalence of lameness from July 2013 to June 2014 was 2.8% (95% CI 2.3–3.5%); this was lower than the GM of 3.5% (CI 3.3–3.7%) of a random sample of 1,300 farmers in 2013 (Winter *et al* 2015). Overall, 39, 90 and 98% of participants had a prevalence of lameness ≤ 2 , ≤ 5 and $\leq 10\%$, respectively; one respondent had a prevalence of lameness of 12%. Approximately 61% treated lame ewes within three days, 56% always, 37% sometimes and 7% rarely used antibiotic injections to treat ewes lame with footrot and 29% never or rarely trimmed the feet of lame ewes. In addition, 63% culled ewes because they had been lame, 35% culled after the second lameness event and 31% culled ewes after they had been lame more than twice. There were 28, 60, 28 and 40% of farmers routinely foot-trimming, routinely foot-bathing, vaccinating and separating lame sheep, respectively. Overall, participants were more compliant, but not completely, with best practice for both treatment and control of lameness than the 2013 respondents (Winter *et al* 2015).

Understanding of the legislation in England relating to lameness in sheep

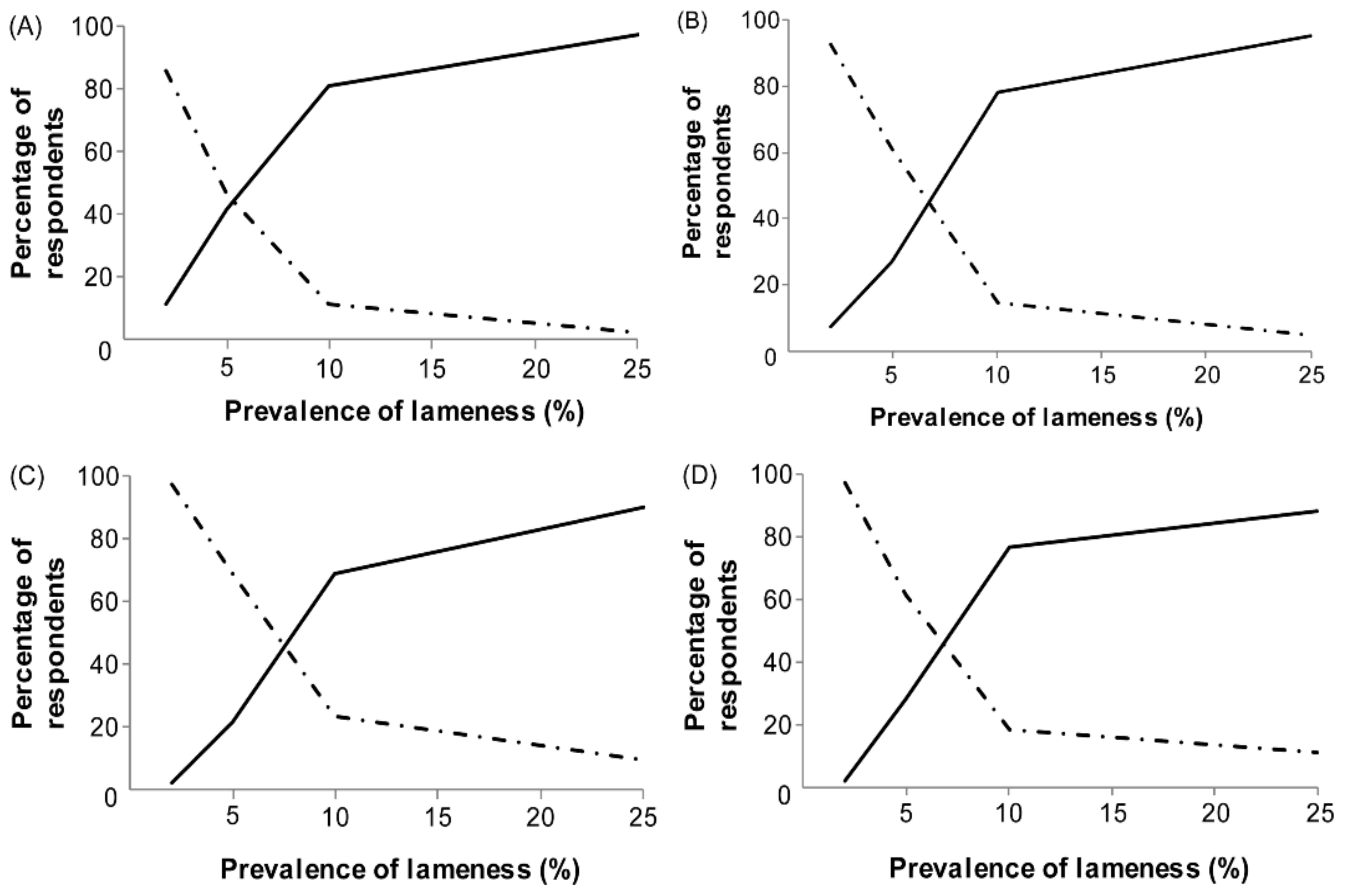
Forty-two percent of participants did not think there were any laws relating to the treatment of lame sheep on a farm, whereas 35% answered correctly that it is 'illegal to have untreated lame sheep on a farm without evidence of intention to treat'; 18% of those who selected the correct statement were very confident, 73% were fairly confident and 9% were not confident with their answer (Table 3).

When asked about the law regarding transport of lame sheep in England, 56% of farmers selected the correct statement that 'it is illegal to transport sheep that are unable to move independently without pain or walk unassisted to any destination'; 50% were very confident of their answer, 39% were fairly confident and 11% were not confident. However, 34% of participants thought that it was 'illegal to transport sheep that are unable to move independently without pain or walk unassisted unless going straight to slaughter' (Table 3).

Attitudes on external inspections for lameness

The frequency of inspections reported by participants was similar to that from a recent survey of 771 farmers in Great Britain (National Farmers Union [NFU] 2015). Of the 38 participants that responded, 16% would not welcome inspection of their flock to check compliance with animal welfare legislation and 37% felt that external inspections to check animal welfare 'wastes time'. In addition, of 39 participants that responded, 41% thought that external inspections were not important in maintaining animal welfare standards. When asked whether they thought there was too much external inspection, 64% were impartial, 23% disagreed and 13% agreed (Table 4).

Figure 1



Theme 1. Forty-two participants' attitudes of an acceptable prevalence of lameness for each scenario: (A) Farmer rarely treats lameness; (B) Farmer has been using the same method to manage lameness over 20 years; (C) Farmer claims to use best practice; and (D) Prevalence rapidly increases despite seeking and following veterinarian's advice. Where lines intersect defines the average upper acceptable prevalence. Solid line: not acceptable prevalence; dashed line: acceptable prevalence.

Themes 1 and 2: Attitudes on fair outcomes of external inspections for lameness

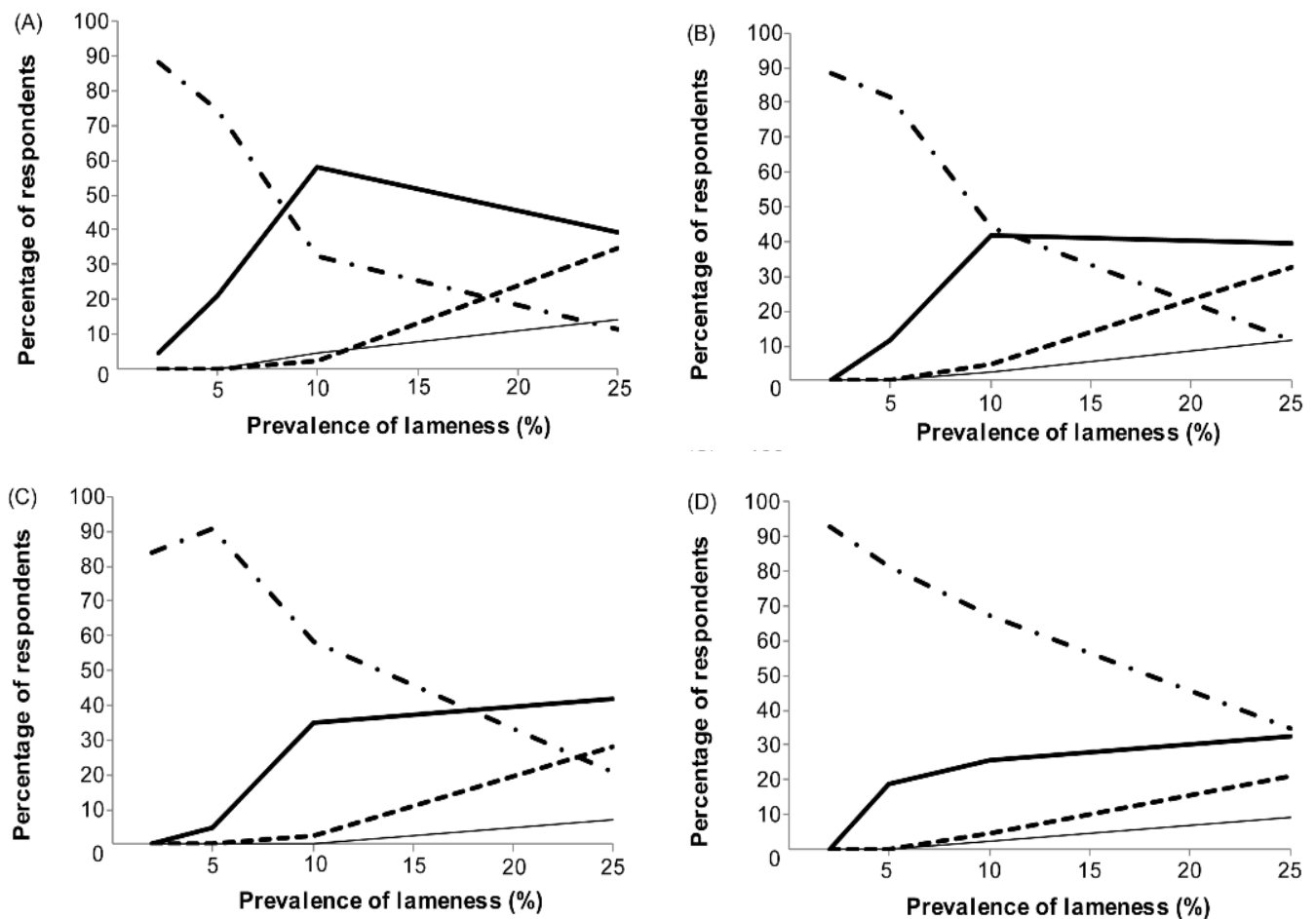
In theme 1 (Figure 1), participants identified 7–7.5% as the upper acceptable prevalence of lameness for 3 of the 4 scenarios (B–D), but 5% for the scenario 'the farmer rarely treats lame sheep' (A). Participants' responses to a fair outcome from inspection in theme 2 (Figure 2) show a number of interesting features. First, suspension of farm assurance membership, a voluntary-based sanction is preferred (Gurerk *et al* 2006) over prosecution. Secondly, the prevalence of lameness, where suspending farm assurance membership is seen to be a fair sanction, varies as a function of scenario. When the farmer rarely treats (A) or uses the same method to manage lameness (B), prosecution is viewed as a fair option at 8–10% lameness, however, when the farmer uses best practice (C) or there is a sudden increase despite seeking advice (D), this increases substantially to approximately 22 and 17%, respectively. Rewards were rarely selected over sanctions. Most participants selected no reward for flocks even with $\leq 2\%$ lameness: only six participants in total selected rewards; a bonus in rural payment ($n = 2$), able to sell to specialist suppliers ($n = 2$) or extra payments per kg lamb sold ($n = 2$).

Theme 3: Attitudes on rewards and sanctions for lameness

Participants identified $\leq 10\%$ as the threshold for a fair legal cut-off prevalence of lameness (Figure 3[A]) and $> 10\%$ when farmers should be penalised (B). They considered that this would lead to a reduction in prevalence of lameness nationally and it would benefit on their own farm. Most participants considered a legal cut-off $< 10\%$ would negatively affect their farm business (A). Participants were increasingly less likely to consider that farmers should be rewarded as the prevalence of lameness increased from 2 to 25% (C). Participants reported that rewards up to 5% prevalence of lameness would impact positively on their farm business, but that rewards up to a maximum of 2% prevalence of lameness would impact negatively on their business (C).

If the same cut-offs for sanctions and rewards identified by the farmers in the current study were applied to the distribution of lameness in the 2013 study of 1,300 randomly selected lowland sheep farmers in England (Winter *et al* 2015), approximately 32.5% of flocks had $\leq 2\%$ lameness and would be rewarded and approximately 24.6% of flocks had $\geq 10\%$ lameness and so would be sanctioned.

Figure 2



Theme 2. Participants' attitudes of a fair outcome for each scenario by A–D. (A) A farmer rarely treats lameness; (B) Using the same method to manage lameness > 20 years; (C) A farmer that claims to use best practice; (D) Prevalence rapidly increases despite seeking and following veterinarian's advice. Thin solid line: prosecution; dashed line: reduction in SPS; thick solid line: suspension of farm assurance membership; and dot dash line: no action.

Discussion

To the authors' knowledge, this is the first study to investigate sheep farmers' attitudes to sanctions and rewards as incentives to control the prevalence of lameness in their own flock and nationally. The participants were convenience-selected because it provided a willing group of respondents, a historic baseline prevalence of lameness and ensured that these farmers were not in another ongoing study of lameness (Winter *et al* 2015). The number of participants was relatively small. Participants had a geometric mean prevalence of lameness in their flock of 2.8%; this is lower than the 3.7% estimate from a random sample of English farmers (Winter *et al* 2015). As would therefore be expected, a greater proportion of participants were using 'best practice' than those in Winter *et al* (2015) when analysing their management strategies, and so we are reasonably confident that whilst we did not define 'best practice' explicitly nor set it as a criterion, the respondents were aware of the principles of best practice to manage lameness in sheep. As the mean prevalence of lameness was lower than for a random sample, it is possible that the cut-offs for acceptable prevalence of

lameness in themes 1 and 2, and rewards and sanctions in themes 2 and 3 might be slightly biased downwards. However, the very consistent pattern of responses that varied by context suggests that participants believed that the national industry and they themselves would be influenced/affected by the theoretical situations proposed.

Participants differentiated an absolute upper limit to the prevalence of lameness that was acceptable (theme 1), an upper limit that depended on scenario (where the farmer's inability to control lameness was identified by participants as a case for leniency) when sanctions could be applied (theme 2) and participants rationally identified how different sanctions and rewards might affect the English sheep industry and themselves (theme 3). These patterns, discussed below, show regularities consistent with farmers using the available information to make decisions about sanctions and rewards.

In theme 1, participants differentiated farmer behaviour and acceptable risk or prevalence of lameness that is tolerated (Figure 1). The farmer who rarely treated lame sheep was given a lower acceptable level of lameness (5%) than the

farmer actively trying to manage lameness (7–7.5%). Interestingly, participants did not distinguish greatly between the farmer using best practice and the farmer using traditional approaches to manage lameness and expected both types of farmers to control lameness equally well. The respondents might not have differentiated the two types of managements; it could be that they assume the two are the same or think that different managements would be effective on different farms.

From theme 2, we see that deviation from the normative acceptable level of 7.5% is needed before it is considered fair for sanctions to be introduced. However, the extent of that deviation depends on the context facing the farmer (Figure 2). If the farmer faces a rapid increase in lameness despite following advice from a veterinarian, then there is greater tolerance. The underlying decision-making mechanism that may account for these patterns cannot be identified from these descriptive results. However, they are suggesting a mixture of rapid affective process (anxiety, gut feelings), slower judgements (cost-benefit analysis) as well as morality and ethics. These are all known to influence judgements about risk, its acceptance and reaction to others' violations of best practice (Slovic 1987; Sjöberg 2000; Slovic & Peters 2006; Kahneman 2011). For example, consider the finding that participants have a higher acceptable risk (are more lenient) for those who are performing best practice; they were more likely to be performing best practice and so this may reflect a 'gut feeling' based on feelings of similarity and we know that people are more generous to those who are similar to themselves (Kahneman 2011). Thus, participants identify with best practice farmers and protect the future self. The sanctioning decisions are then anchored relative to the acceptable level of risk of lameness of 7.5% that participants identify for good farmers (Tversky & Kahneman 1974) and they are, intuitively, more lenient towards farmers managing lameness like themselves. In addition, participants were more lenient towards the farmer who could legitimise their negative outcome (Lotem *et al* 1999; Ferguson *et al* 2012), showing that once the acceptable threshold for the good farmer was crossed, then sanctions were proportional to the degree to which the farmer had some control over any outbreak. Pragmatically and anecdotally, these results reflect the concern farmers have that inspectors and legislation cannot differentiate a sudden high uncontrollable prevalence of lameness from ongoing high prevalence of lameness for a fair outcome of inspections (LE Green, personal communications since 2004).

The critical prevalence, selected by participants, for acceptable prevalence of lameness and cut-offs for sanctions and rewards were generally protective of their own situation (theme 3), with the exception that whilst rewards for lameness prevalence $\leq 2\%$ was selected as fair and effective nationally, approximately 40% of participants said this would impact their own business negatively and considered a fair reward when lameness prevalence was $\leq 5\%$ would benefit their business. This suggests that these farmers know that the prevalence of lameness in their flock exceeds 2%, at least on occasion.

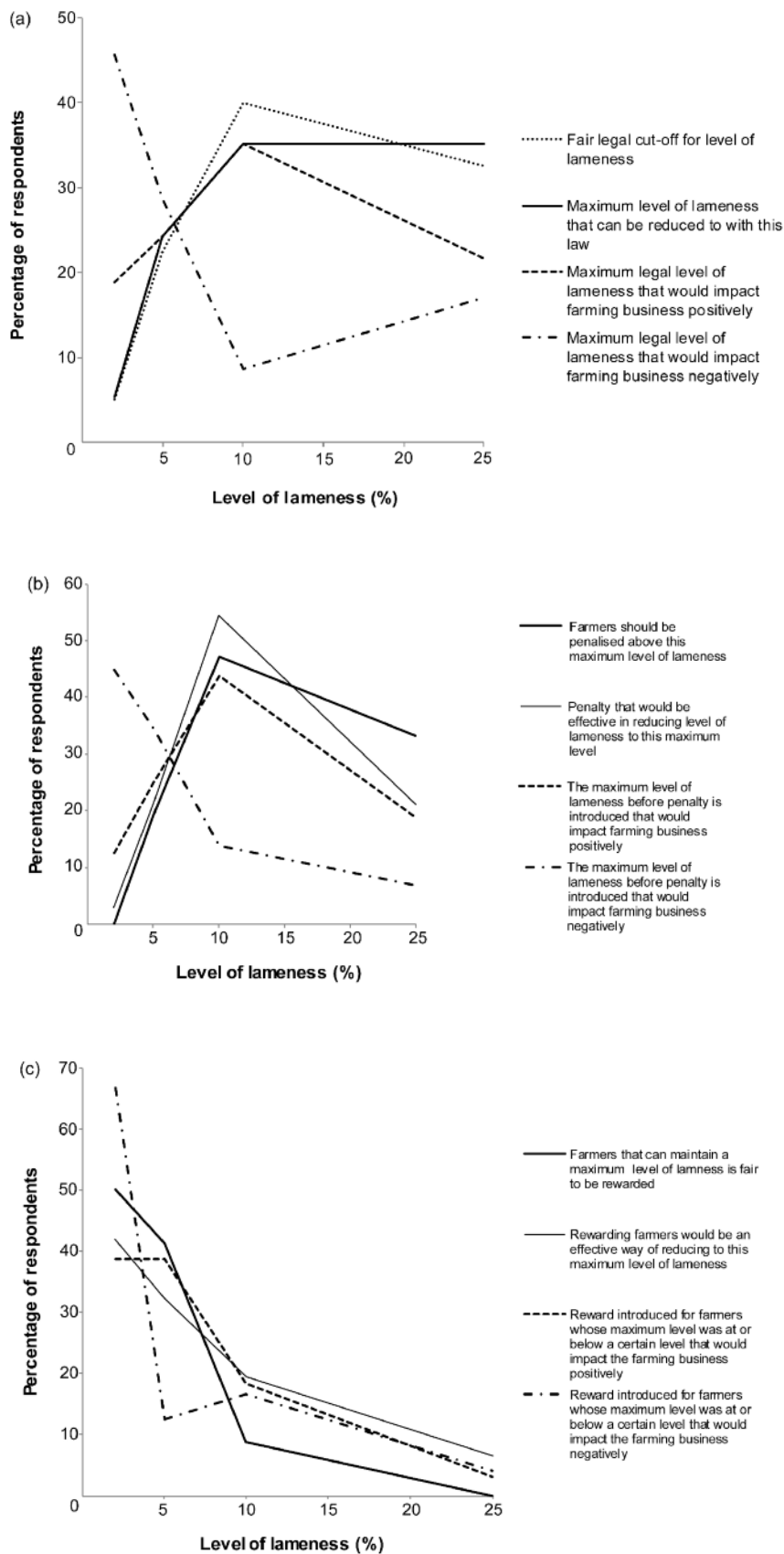
Consistent with the literature, in theme 2, participants preferred to sanction negative outcomes rather than reward positive outcomes (Fehr & Gächter 2002), although prosecution as a sanction was rarely selected as a fair outcome. This may reflect the feeling that losses loom larger than gains and people believe that sanctions result in greater behaviour change (Kahneman & Tversky 1979). However, the evidence for the relative effectiveness of rewards (incentives) and sanctions is not fully understood nor clear and to some extent, is dependent on the nature of the behaviour that is trying to be changed, and the person who is trying to change (Balliet *et al* 2011; Gneezy *et al* 2011; Ferguson & Starmer 2013; Boyce *et al* 2016).

Whilst legislation relates to every individual animal, the context of farming is that farmers work with populations of animals. This is challenging and makes interpretation of the law complex. According to the law, animals that are lame with no evidence of treatment can result in prosecution for failing to treat. However, a farm with some untreated lame animals, with evidence of an intention to treat, can be deemed acceptable. The cut-offs of prevalence of lameness $> 2\%$ selected by most participants in the current study indicate that those farmers considered some untreated lame sheep acceptable. We did not investigate whether these would be in a planned programme of treatment.

Currently, the proportion of sheep farmers sanctioned for high prevalence of untreated lameness is not known. There were 63 RSPCA convictions under the Animal Welfare Act (2006) for all farmed animals in 2013 (RSPCA 2013b). It is not possible to differentiate which of these were related to sheep, but it is clearly a very low number. With the cut-offs in the current study applied to respondents to Winter *et al* (2015), 24% of flocks would be financially sanctioned in our theoretical framework. This would increase sanctions above current activity hugely, but it would still be for prevalence of lameness of $> 10\%$, higher than might be expected if current legislation were fully enforced. If rewards were acceptable and effective, as indicated by participants, then this might be a better approach and encourage farmers to reduce flock prevalence of lameness to $< 2\%$: the FAWC goal (FAWC 2011).

Four participants suggested that veterinary advice should be sought when the prevalence of lameness was high, whilst two highlighted the annual visit from their veterinarian as an external inspection. It is a legal requirement that veterinarians can only prescribe medicines to animals directly under their care. Some practice standards therefore include inspection of animals on-farm at least once a year. One hypothesis to consider, given the desire by Government for more private regulation, is that if all sheep flocks were inspected by their veterinarian each year, this could be a route by which new information on best practice for lameness, and other updates on managing health could be discussed with farmers, it would improve dialogue between farmers and veterinarians (Kaler & Green 2013; Bellet *et al* 2015). One survey suggested that approximately 22% of sheep farmers have all-year-round contact with their veterinarians (Agricultural

Figure 3



Theme 3. Attitudes of 42 English sheep farmers by percentage of participants on how sheep farmers are rewarded or sanctioned for lameness in their flock showing: (a) the fair legal cut-off for the maximum level of lameness in sheep flocks; (b) the prevalence of lameness above which a penalty should be introduced; and (c) the prevalence of lameness below which a reward should be introduced.

Development and Advisory Service [ADAS] 2008). If this were able to be increased, then these visits could be a one-to-one facilitated discussion and opportunity for new information to be given to farmers whatever the prevalence of lameness, to lead to more rapid improvement in the management of lameness in sheep, assuming veterinary knowledge (Kaler & Green 2013). This could be audited by quality assurance schemes and together these activities might further decrease prevalence of lameness.

Participants' knowledge of current welfare legislation was poor with many farmers unable to identify the correct interpretation of legislation, and those who correctly identified the legislation indicated that they were not confident of their choice. It might be that the legislation, which is necessarily general to ensure it can be used appropriately, is confusing for farmers (and others in the livestock industry). This issue has been discussed recently in a consultation by Defra (Defra 2011, 2013) with the proposal to reform farm animal welfare codes so that they are moved from statutory codes to guidance drafted collaboratively with government, but led by the relevant sector of the livestock industry. The aim would be to "ensure that guidance on how keepers comply with farm animal welfare legislation is up to date, reflecting the latest scientific and veterinary knowledge whilst being presented in the most relevant way for farmers" (Defra 2014). The current situation (2016) is that this has not been approved (*The Veterinary Record* 2016). Whilst the participants had poor ability to identify the legislation on lameness, the average prevalence of lameness in their flocks was relatively low. This might indicate that knowledge of the law is unnecessary to manage lameness and that clearer explanation is not necessary. It could, however, be that if farmers were more aware of the legislation, that the stockperson should understand diseases in their flock, then all farmers would adopt best practice for management of lameness and every lame sheep would either be treated or scheduled for treatment within three days, then the prevalence of lameness would be < 2% as in Wassink *et al* (2010).

Animal welfare implications and conclusion

As a study that investigated farmers' attitudes to including welfare measures within external inspection frameworks, these results might be used to evaluate whether, and how, external inspections could be used to reduce the prevalence of lameness in sheep and inform on the role of sanctions and rewards in welfare of sheep generally. It was observed that sanctioning (mainly to suspend farmers from their farm assurance membership) would be initiated above 10% lameness, which could potentially encourage the 24% farmers with > 10% lameness (Winter *et al* 2015) to reduce levels of lameness by introducing best practice. The flock prevalence of lameness is highly skewed and targeting flocks with the highest prevalence of lameness would reduce the global mean prevalence of lameness in the national flock, currently at 5% to < 4%. Rewarding low prevalence of lameness could encourage more than the current 33% of

farmers to maintain a prevalence of lameness of < 2%. In addition, the national prevalence of lameness might fall if all farmers followed the legislation that farmers are responsible to care for their livestock and use best practice.

Acknowledgements

Data for this research were funded by Defra as part of AW0512. NL was funded by the University of Warwick, LG and JK are funded by BBSRC. The authors thank the farmers for completing the questionnaire and Dr Annmarie Ruston for her input to the literature review.

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