

Veterinary vaccination advice and perceived farmer compliance on UK dairy farms

Vaccination is a commonly used disease control strategy in dairy farming in the UK. Farmers perceive their veterinarian to be the most important source of information for vaccination advice. However, poor compliance and perceived confusion on appropriate vaccination strategies suggest that there is variation in the advice that farmers are receiving. This study compared veterinarians', veterinary students' and farmers' perceptions and approach to vaccination strategies on dairy farms through the use of survey questions, discussion groups and a posed case scenario. The vaccination advice for one case scenario was variable between many participants in this study. Results suggest that although veterinarians are aware of suboptimal farmer compliance, and they recognise the motivators and barriers of farmers to comply with vaccination, actions to improve farmer compliance could be improved. Suggestions are given to provide veterinarians with, currently lacking, information which is helpful in the decision-making process to achieve the best vaccination advice. The study also addresses potential areas which may aid communication and compliance when implementing vaccination strategies on UK dairy farms.

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Vaccination in veterinary medicine has historically been used to help control diseases in animal populations (Lombard et al, 2007), but correct usage including storage, route and timing of administration is required in order for the vaccine to adequately protect against disease (Salisbury et al, 2006).

Recommended vaccination protocols are published on the datasheet accompanying the vaccine. There is, however, no legal requirement to issue datasheets under the Veterinary Medicine Regulations (VMR), as the Summary of Product Characteristics (SPC) is currently the legal approved document for all veterinary

medicines under the VMR. Full SPCs for all authorised veterinary medicines are made available by the Veterinary Medicines Directorate (VMD) on their website (www.vmd.defra.gov.uk/ProductInformationDatabase). The traditional datasheet accompanying the vaccine is often an abbreviated form of the SPC prepared by the individual companies concerned. In the UK, vaccines must be prescribed by a veterinarian or a 'suitably qualified person', depending on the type of vaccine. These people are qualified to make decisions about appropriate vaccination protocols and advise on correct administration (National Office of Animal Health, 2012). However, research has demonstrated that

Table 1. Questions for participants about on-farm vaccine usage and compliance

Q1	List three concerns you have with regards to vaccine use on farm
Q2	Why do you think farmers do not vaccinate their cattle?
Q3	What proportion of farmers will start vaccinating their cattle at the time they should (according to the datasheet)?
Q4	What proportion of farmers will give a second dose at the right time as part of an initial course (according to the datasheet)?
Q5	What proportion of farmers would start vaccinating too early (interference of maternal antibodies) (according to the datasheet)?
Q6	What proportion of farmers would use the correct route of administration (according to the datasheet)?
Q7	What percentage of farmers do you think see you/the veterinary practice as most the important source of information regarding vaccination?
Q8	What percentage of clients would purchase vaccines from you/the practice?

vaccines on farms are not always used according to the datasheet recommendations (Meadows, 2010).

Ninety five percent of farmers see their veterinarian as the most important source of information with regards to vaccination (Cresswell, 2011). It has been suggested that this is because veterinarians' knowledge is locally contextualised, they provide immediate one-to-one advice, and they work in the farmer's interest (Garforth et al, 2013). Therefore the veterinarians' advice is likely to be pivotal in the implementation and development of vaccination strategies in the UK.

National disease control requires a concerted effort, particularly by veterinarians and farmers at the forefront of farm animal production (Gilbert et al, 2013). However, there is significant individual variation in veterinarians' approaches to disease control (Higgins, 2013). While a tailored approach is required to cater for the needs of individual farms, variation in decision making is likely to result in different and potentially conflicting advice from veterinarians to farmers.

Joint decision making with the farmer is important when deciding on a vaccination strategy on farm (Kristensen and Jakobsen, 2011). A minority of farmers choose not to use any vaccines on their animals, and possible reasons for this could be: being unaware of the need for specific disease control on a farm; a perceived low risk; vaccination not being justified in a cost-benefit analysis; or previous problems with vaccines (Elbers et al, 2010). The UK dairy levy board (DairyCo) recently requested more information on the current approaches to vaccination strategies on UK dairy farms, as they perceived there was uncertainty among farmers on best practice guidelines (personal communication).

Data collection

Discussion groups can be used to explore participants' thoughts and opinions (Dohoo et al, 2003). They are less constrained by the structure of questionnaires and therefore may raise topics that could otherwise not be addressed by written questions. Where numbers of participants are limited the findings may not be representative of

the wider population, but in the absence of other information, the findings provide a starting point to guide further research.

This study investigated veterinarians' and final year veterinary students' approaches to cattle vaccination strategies in the UK. Veterinary students rely strongly on their veterinary education to make decisions about disease control strategies, whereas veterinarians who have experience in practice use that experience to aid their decision making.

The aim was to describe veterinarians' and final year veterinary students' approaches to vaccination of dairy cattle in the UK and to identify motivators and barriers that drive vaccination advice. In addition, veterinary perception of farmer vaccination compliance was compared with farmer compliance, as reported by UK cattle farmers, collected in a survey performed in 2011 (Cresswell, 2011).

Materials and methods

Two discussion groups were held on separate days: Group 1 took place in January 2013, Group 2 in February 2013. Each discussion group was presented with two identical tasks.

Group 1 (veterinarians) — comprised 13 experienced veterinary practitioners and academics from across the UK, with demonstrable expertise in dairy herd health and production.

Group 2 (students) — consisted of 11 final year students at the School of Veterinary Medicine and Science, Nottingham, UK.

Both groups completed two tasks. Group 1 also participated in an informal discussion between the 13 veterinarians to further explore both farmers' and veterinarians' barriers and motivators to effective vaccination strategies. These sessions were moderated by one of the authors.

Task 1

Both groups were provided with the following scenario: *'A client asks you for advice regarding vaccinating his dairy cattle; describe what you would advise, in practical detail (when, what, how, who, cost, benefits etc).'*

The following case history was provided:

'Mr Yeo has just taken over his father's dairy herd. The vaccination history of the cattle is a bit sketchy and so he wants to set out a strategy for the herd. They are a conventional, summer grazing herd of 150 milking cows. They have everything on site from baby calves to adult cattle, and he is considering keeping his dairy bull calves this year for rearing. Youngstock is grazed across the road in summer and kept in a barn in winter across the road as well. Mr Yeo would like the herd to be closed but at the moment it is not feasible. He asks you for vaccination advice on what to use and when, and is wondering if all available vaccines are really necessary. His dad was reluctant to vaccinate, thus far they used Lepto and sometimes a couple of other vaccines. However, he cannot remember which ones or when their previous veterinarian had recommended these.'

Participants had the opportunity to ask for further information. Answers were provided by one of the authors playing the role of Mr Yeo, and were recorded in order to provide consistent answers between the two groups (where asked). Participants were asked to write down what their advice would be to the farmer in this scenario, without discussing their thoughts with the other participants.

Table 2. Questions considered relevant by at least one veterinarian or student in order to provide suitable vaccination advice in the posed case scenario

Question	Answer
Current disease status	
Are there any current laboratory results available to view?	No
Is any mastitis information known?	Average
What is your herd's abortion history?	None
Is there any skin disease present?	No
Youngstock	
What current diseases are there in the youngstock?	Respiratory disease, not much diarrhoea
Are all age groups in contact with each other?	Yes
How are youngstock kept?	Not great
Farmer preferences	
Would you consider further diagnostic testing?	Yes
How much would you like to spend?	Not sure
What are your plans for the future?	Now stable, would like to expand in the future and have a closed herd
Can you afford a new shed soon?	No
How risk averse is Mr Yeo?	Average
Current farm management	
Are you milk recording?	Yes
Does this include fertility/service data?	No
What is the average milk yield?	Approximately 8000 l/cow, this is what the client expected
Do you use a bull?	Sweeper bull
Who is in charge?	Mr Yeo (just taken over from father)
Is anybody else employed on the farm?	Relief milkers, occasional farm labourer
Is this a seasonal calving herd?	No, all year-round calving
What is the percentage of heifers in the herd?	20%
What is the average age of the heifers?	Average, 26 months
What are the current losses on the farm?	Not aware of anything in particular
What current treatments are being used?	Youngstock get pneumonia treatment (antibiotics and non-steroidal anti-inflammatory drugs) as an almost regular event every year
Biosecurity	
What do you do about restocking?	Buy in milkers and heifers from market
What contact do your cattle have with other animals?	No other animals on the farm. Have nose to nose contact with other cattle over the fence
Do you have any sheep?	No

Task 2

Both groups were asked eight questions about on-farm vaccine use and compliance (*Table 1*).

Seven of these questions had previously been asked to farmers, and answers from Group 1 and 2 were compared with this farmer data (Cresswell, 2011). For comparison, 'correct usage' was defined as following the recommendations provided in the datasheet (National Office of Animal Health, 2012). The results were manually entered into Microsoft Excel. Where qualitative answers were given, these were grouped using thematic analysis (Attride-Stirling, 2001).

Respondents were categorised as either 'veterinarians' or 'students'. Where deemed appropriate, the groups' answers were merged. Two sample Z-tests were carried out to compare answers from the different groups using EpiTools epidemiological calculators (Sergeant, 2009), and relevant significant ($p < 0.05$) associations were reported.

Results

Task 1 – case scenario

Further information requested

Questions asked by at least one veterinarian or student in order to

Table 3. Recommendations given by 13 veterinarians and 11 students to a dairy farmer in the posed case scenario

Recommendation	Veterinarians % (95% CI)	Students % (95% CI)
Testing (bulk milk, serology, tag testing)	77 (54–99)	36 (16–74)
Need more information ¹ *	77 (54–99)	9 (0–26)
Manage environment ²	62 (36–88)	45 (16–74)
Evaluate cost–benefit	38 (12–64)	9 (0–26)
Zoonotic/health and safety issues	23 (0–46)	9 (0–26)

1 – Including ‘establish disease status/incidence’, ‘look at records’, ‘fertility data’, ‘mortality data’, ‘antibiotic treatment/usage’.
 2 – Including ‘general management’, ‘housing’, ‘stocking density’, ‘biosecurity’ and ‘colostrum intake’
 * – Significant difference between proportion of veterinarians and students ($p < 0.01$)

Table 4. Advice for the use of vaccines against specific diseases, or disease complexes, given by 13 veterinarians and 11 students to the dairy farmer in the posed case scenario (dash indicates that none of the participants recommended the vaccine)

Vaccines*	Veterinarians %			Students %		
	Immediate	Investigate	Consider	Immediate	Investigate	Consider
Bovine viral diarrhoea	31	23	–	45	18	–
Leptospirosis	31	31	–	55	–	–
Calves – pneumonia	23	8	15	64	–	9
Clostridials	15	23	–	9	–	–
Lungworm	15	8	–	9	–	–
IBR	8	31	8	27	–	–
Calves – diarrhoea	–	–	15	27	9	–
Salmonella	–	–	–	–	–	–
Mastitis	–	–	8	–	–	–

* ‘Immediate’= Vaccinate now, ‘Investigate’= Consider vaccination after further information, e.g. testing (type not specified), clinical signs, and further history, ‘Consider’= Vaccination is a future consideration

provide adequate vaccination advice are listed in Table 2. These questions were predominantly asked by Group 1 (veterinarians).

Advice given

Many veterinarians recommended additional testing (Table 3) and the majority considered bovine viral diarrhoea (BVD) and leptospirosis vaccination in their recommendation (Table 4).

One veterinarian asked whether Mr Yeo’s account with the veterinary practice was up to date. Out of four veterinarians who recommended clostridial vaccines, two of these stated the motivation for this being ‘low cost, and therefore a benefit is likely’. Two veterinarians mentioned the need to assess the bull. One student gave specific costs and vaccination protocols. One student said that the exercise had uncovered a ‘massive gap in (their) knowledge’, and expressed that they would feel more confident with small animal vaccination strategies.

Task 2 – questions regarding vaccine use

When asked to list three concerns that participants had with regards to vaccine use on farm (Q1, Table 1), there was a difference between the proportion of veterinarians’ and students’ answers

for ‘storage of vaccines’ ($p = 0.04$), ‘timing of vaccination’ ($p = 0.01$), and ‘efficacy of vaccine’ ($p = 0.02$) (Table 5).

Farmers (survey data collected in 2011, Cresswell 2011) and veterinarians agreed that ‘not being aware of the need to vaccinate’ was one of the main reasons for not vaccinating their cattle, there was, however, a significant difference between the other answers that veterinarians and students gave, versus farmers (Table 6).

Farmers’, veterinarians’ and students’ responses were often similar with regards to the questions asked on vaccine usage and compliance (Q3–Q8); however, some students and veterinarians underestimated the influence of the veterinarian as a source of information for farmers (Figure 1).

The range of responses from individual veterinarians and students was considerable, ranging from 5% to 90% for some questions (Table 7).

Discussion with Group 1

The following section summarises the informal discussion held with Group 1; items have been grouped into themes highlighting barriers or motivators to effective vaccination strategies.

Cost

The theme of cost was repeatedly raised throughout the discussion. Many veterinarians agreed that the cost–benefit of vaccination is difficult to quantify, both in terms of initial recognition of a problem, particularly in ‘insidious losses’ for endemic diseases, rather than an acute disease outbreak, and in seeing the benefits once a vaccination strategy had been implemented. Cost was mentioned as a barrier to the farmer choosing to vaccinate, and to the veterinarian when initiating a vaccination strategy. The one-off cost of a batch of vaccines was thought to be prohibitive as opposed to other ongoing costs — a comparison was made with feed additives. It was noted how farmers may express concern about the initial cost of a vaccine, but once purchased may not use the vaccines correctly. One veterinarian perceived that they had had a better response from farmers when vaccination was presented as a ‘potential gain’, rather than ‘preventing losses’.

Efficacy and adverse reactions

Many veterinarians agreed that there was a lack of published evidence surrounding the efficacy (i.e. animal health or herd production improvement after vaccination) of cattle vaccines in the field. This was a barrier to demonstrate cost effectiveness. Veterinarians felt they could not easily discuss concerns about vaccine efficacy with the farmer, as this may discourage any vaccination. Concern was expressed at recommending vaccination (as well as recommending not to vaccinate) if a disease breakdown subsequently occurred.

Field efficacy data of a vaccine post registration was seen as important missing information. It was suggested this may become available in the future using simulation modelling techniques, as actual field trial costs are likely to be prohibitive. The multifactorial nature of disease was identified as a difficulty in quantifying efficacy of preventative strategies, such as vaccination.

Previous ‘bad experiences’ with vaccine efficacy and adverse reactions, such as embryo loss and concerns around the aetiology of bovine neonatal pancytopenia were seen as barriers to farmers choosing to vaccinate in general.

Compliance

Although efficacy was deemed as important, compliance was thought to be similarly important. It was questioned whether there is any evidence that not following the datasheet affects efficacy. For the timescale in which to administer vaccines, it was suggested that experience in the field was relied on over datasheet recommendations. It was pointed out that the effect of nutritional status on immunity may be overlooked during a discussion surrounding the vaccination of immune-compromised animals. Poor storage was thought to be of greater significance in producing a poor immune response than route of administration.

Combining vaccines was recognised to be off-licence, and it was suggested that vaccine interactions are more likely to be noticed as adverse effects at the time of vaccination than as a lack of vaccine efficacy. It was noted that in human medicine adverse reactions were largely due to the adjuvants in vaccines.

Table 5. Q1: ‘List 3 concerns you have with regards to vaccine use on farm’, answered by 13 veterinarians and 11 students

Concerns	Veterinarians% (95% CI)	Students % (95% CI)	Total %
Not following datasheet	85 (66–104)	55 (26–84)	71
Storage of vaccine*	69 (44–94)	27 (1–53)	50
Timing of vaccination*	23 (0–46)	73 (47–99)	46
Route of administration	31 (6–56)	18 (0–48)	25
Efficacy of vaccine*	38 (12–64)	0	21
Not knowing disease status	23 (0–46)	18 (0–41)	21
Not using correct dose	23 (0–46)	18 (0–41)	21
Compromising other aspects of disease control ¹	8 (7–23)	27 (1–53)	17
Cost:benefit	23 (0–46)	0 (0–0)	13
Health and safety	8 (7–23)	9 (0–26)	8
Dirty needles	8 (7–23)	0	4
Multiple vaccines used at once	8 (7–23)	0	4
Out of date vaccines	0	9 (0–26)	4
Over-vaccination	0	9 (0–26)	4
Sick animals being inappropriately vaccinated	8 (7–23)	0	4

* Indicates a significant difference between students and veterinarians
¹ Including ‘seeing vaccination as a magic bullet’, and ‘compromising biosecurity’

Motivators and barriers

Motivators for vaccination were ‘insurance cover’, ‘easy risk management’ and ‘defensive treatment’ against disease. Several veterinarians suggested that vaccination may be relied on for disease control to the extent that other biosecurity measures may be compromised, or active surveillance is not carried out. It was noted that disease can recur and the question, ‘how do you know when to stop vaccinating’ was raised. The effect of vaccination affecting the ability to identify the disease status of a farm was also raised as a potential barrier to vaccination.

The term ‘vaccine fatigue’ was repeatedly used during the discussion, particularly with regards to complicated protocols and fitting these in around farm management. It was suggested there were too many vaccines available — the addition of Bluetongue virus vaccine was given as an example. It was suggested that this may be partially cultural, and comparisons between the UK and the USA, where vaccination is more commonplace, were made. One participant queried whether we have the ‘right vaccines’, as there was a perception that ‘industry is not interested in minor and endemic diseases’.

Paraprofessionals

Differing opinions were offered on the use of paraprofessionals to carry out vaccination on farms; it was perceived as a job that a farmer ‘will not pay for if he can do it himself’, but it was also suggested that clients often ‘liked the idea of contracting out jobs’ and passing on the responsibility for correct usage, particularly

Table 6. Q2: 'Why do you think farmers do not vaccinate their cattle?', answered by 13 veterinarians, 11 students and 33 farmers¹

	Veterinarians %	Students %	Veterinarians & students % (95% CI)	Farmers % (95% CI)
Not needed/not aware of vaccination being needed	69	64	67 (48–86)	70 (54–86)
Effort/hassle*	85	18	54 (34–74)	6 (0–14)
Cost:benefit not justified*	85	100	92 (81–100)	6 (0–14)
(Lack of) advice/information*	38	36	38 (19–57)	3 (0–9)
Time constraints*	31	45	38 (19–57)	3 (0–9)
Not sure of efficacy*	15	18	17 (2–32)	0 (0–0)

* Indicates a significant difference between 'students & veterinarians' and 'farmers'
¹ – data from Cresswell, 2011

where they 'never get round to it' themselves. It was noted that in some countries, such as The Netherlands, vaccination is rarely carried out by the farmer.

Communication

Whether effective communication with farmers is better achieved by an intermittent, informal approach at routine visits or by 'scheduled meetings with written reports' was discussed. It was argued that this depended on the individual client, and veterinarians should ask 'what the farmer wants'. Methods for improving communication with farmers with regards to their vaccination strategies were: 'return slips', individual calendars for farm clients, and reminders via social media. Respondents had little to no experience of the latter approach with clients. The experience was shared that communication breakdown often occurred due to information not being passed on to the correct person.

Discussion

Our findings suggest that veterinarians could play a more prominent role in advising the farmer about vaccination and applying

correct vaccination protocols. The data suggest that veterinarians are aware that compliance is poor in some areas (e.g. only around half of farmers are correctly administering second doses in primary courses). In the discussion suggestions were made on how to address timing issues (e.g. reminders, calendars, text messages) and other compliance issues. Although the client's veterinarian was most commonly stated as the main vaccine provider, it was unknown how much discussion takes place about appropriate usage and protocols when the vaccine is handed over. This was noted in the discussion, as 'such information is often passed to the wrong person'. This may be addressed by vaccine suppliers providing clear labelling of the vaccines.

Overall veterinarians perceived cost to be the greatest barrier to vaccination (92%), but this was different to the proportion of farmers perceiving cost to be a barrier (6%). However, previous research has found that a large proportion of farmers (47%) discussed the cost of vaccines with their vaccine supplier (Cresswell, 2011). Elbers et al (2010) found that economic factors are the main motivators for farmers when making decisions about vaccination strategies. However, non-monetary factors may be equally as motivating in farmer decision making (Valeeva et al, 2007).

The majority of veterinarians (77%) stated that they would advise disease testing before recommending a vaccination strategy. This confirms that veterinarians feel the need for more information before they can give vaccination advice. However, it was also noted that information, such as field efficacy data, was not available, and veterinarians are uncomfortable about providing advice without having all the relevant information. This decision making in situations where information is lacking appears to result in differing advice. These decisions may come from experience, previous training or other sources and make it difficult for veterinarians to present a united approach. The request for more (evidence-based) information on, for example field efficacy and the cost benefit of vaccination, has been acknowledged by the veterinary profession and the Centre for Evidence-Based Veterinary Medicine at the University of Nottingham is making progress in providing more evidence for veterinarians to base their decision making on.

The various considerations questioned by veterinarians in response to the case scenario emphasise the multifactorial

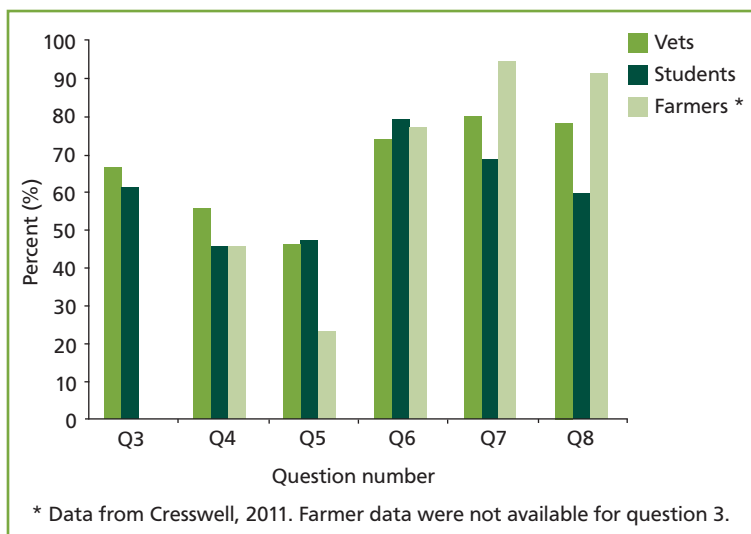


Figure 1. Answers from 13 veterinarians, 11 students and 33 farmers in response to questions Q3–Q8 (Table 1) about on-farm vaccine usage and compliance.

Table 7. Ranges of answers from students and veterinarians combined to Q3-8 (Table 1). Student and veterinarian data were merged (n=24) as response ranges were similar

Question	Range %
Q3	20–90
Q4	20–90
Q5	5–90
Q6	50–95
Q7	25–90
Q8	30–100

nature of decision making in disease control. While some veterinarians asked questions about farmer preferences (e.g. 'How much would you like to spend?', 'What are your plans for the future?' and 'How risk-averse is Mr Yeo?'), no one asked what Mr Yeo aimed to achieve through a vaccination strategy. This may indicate that farmer priorities may be assumed by the veterinarian, instead of being established in conversation with the client. It was interesting to note that reduced animal welfare as a result of not vaccinating was not queried as a motivator.

There is the requirement to consider the herd as well as an individual animal's health. As '100% protection' of each individual animal in a vaccinated herd is unfeasible, it is important to consider herd immunity and not use vaccination as the only tool to control disease. Disease control in production animals is pressured due to the commercial nature of the majority of farming enterprises; the farmer and the veterinarian need to consider the cost and benefit of each intervention.

The approach to communicate with the farmer ranged from an informal discussion during routine visits to a sit-down meeting with written reports. Kristensen and Jakobsen (2011) discuss communication between the veterinarian and farmer, concluding that the approach required varies between farmers, which was supported in our findings. These considerations highlight how it may be difficult for veterinary practices to implement standard protocols for approaching vaccination strategies on farms, as the optimal strategy will depend on the individual farmer preferences and farm type.

Our findings indicate that veterinarians are concerned that storage and administration of vaccines could affect vaccine efficacy. Understanding the principles behind vaccination may help in applying the correct protocol, and the veterinarian needs to acknowledge the level of training of the person administering the vaccine. The development of licensed multi-disease vaccines may improve compliance and help reduce vaccine fatigue. Guidance from the veterinarian is highly valued according to our and previous research (Hall and Wapenaar, 2012) and may improve compliance, as well as stimulate further conversation about disease control strategies.

This study highlighted differences between veterinary students and experienced practitioners. This has consequences

KEY POINTS

- Although veterinarians' perceptions of compliance range widely, they generally had a good understanding of the low level of compliance of farm clients regarding vaccine usage on farm. Many reasons for non compliance were listed and could be addressed by on-farm discussions.
- Farm clients may not be aware of the potential benefit of vaccination.
- Farm clients see their veterinarian as the most important source of information, which was underestimated by veterinarians and veterinary students. Being aware of the veterinarian's role places them in the best position to initiate discussion and to deliver the best advice.
- Further studies into the field efficacy of vaccines are called for to aid decision making and cost–benefit analyses; this can be pursued via, e.g. field trials and simulation modelling. Currently there is variation between veterinarians with regards to vaccination advice. For the credibility of the profession it is deemed important to have broad agreement over such preventive medicine strategies.
- The use of different forms of communication tailored to the individual farmer may help improve uptake and compliance of vaccine usage, e.g. discussions on routine farm visits, discussion groups, newsletters, herd health visits with written reports and the use of technology for 'booster reminders'.
- Alternative labour sources, such as paraprofessionals, for delivering vaccination on farm or the development of multi-disease vaccines could help to increase compliance, reduce the perceived effort involved in vaccinating cattle and reduce 'vaccination fatigue' for both veterinarians and farmers.

for the delivery of vaccination advice. Veterinary (undergraduate) education is an important opportunity to educate future veterinarians on vaccine advice to farmers. This study suggests that education in vaccination strategies can be improved; it should include guidance on how to assess and communicate the cost–benefit of implementation and how to assess the available efficacy evidence in the context of a clinical situation.

In order for disease to be controlled at a national level, a concerted effort is required by veterinarians. Although individual clinical decision making will vary, it is important to understand the reasons for these decisions in order to develop effective vaccination and disease-control strategies. There is guidance available to veterinarians about vaccination protocols (RUMA, 2007; National Office of Animal Health, 2012), and a united approach towards effective vaccination and disease-control strategies from the profession as a whole may aid individual veterinary decision making, and prevent confusing and conflicting advice being provided to clients. This united approach would be strengthened by the inclusion of other stakeholders such as the drug manufacturers and the government.

Conclusion

This study highlights some of the different approaches that veterinarians may take towards vaccination strategies, and some of the concerns they have. The findings are limited by the numbers of participants in a biased population of veterinarians who have a specific interest in dairy herd health. However, in the absence of other information it provides a starting point to focus further advice and research. Current research at the University of Nottingham is further investigating motivators and barriers of farmers, veterinarians and other stakeholders towards vaccination strategies in dairy cattle, with the aim to develop a practical approach to optimise vaccination strategies for the dairy industry. **LS**

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