Impact of Research on Contagious Ovine Digital Dermatitis on the Knowledge and Practices of UK Sheep Farmers and Veterinarians.


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Abstract

Background

Contagious ovine digital dermatitis (CODD) is a common foot disease of sheep which causes a severe form of lameness and can be difficult to control. Recent research has provided evidence-based guidance on diagnosis, treatment and farm management control. The aim of this study was to determine the uptake of this guidance on the knowledge and practices of UK sheep farmers and veterinarians and identify priorities for future research.

Methods

Data was collected in 2019-20 by electronic surveys of UK sheep veterinarians and farmers distributed through sheep industry organisations and social media.

Results

284 sheep farmers and 77 veterinarians responded to the surveys. 52% of farmers and 70% of vets considered that their management of CODD had improved as a direct result of recent research evidence on the disease. The principle areas improved for both sectors were biosecurity advice and use of antibiotic treatments. Farmers and veterinarians reported that the priorities for future research should be in therapeutics, vaccine development and the understanding of disease transmission.

Conclusion

There has been strong uptake of recent evidence based veterinary medicine by farmers and veterinarians for the management of CODD, particularly in the areas of biosecurity and responsible antibiotic use.

Introduction

Contagious ovine digital dermatitis (CODD) is recognised as one of the most important causes of sheep lameness in the UK (1, 2). It was first recognised in 1997 (3) and is now
reported to occur widely (1, 4, 5), with recent estimates indicating between 35 and 58% of
UK flocks infected. Until 2011/2012 there was a paucity of research on CODD (5-7). Treatment of the disease was particularly problematic with no evidence base to support clinical decision making. Consequently, in the light of the severity of the lameness caused by CODD, whole flock metaphylactic treatments with antibiotics and antibiotic foot bathing were common practices to control disease outbreaks. In the context of emerging global concern regarding antibiotic resistance and responsible use of antibiotics in farming, there was scepticism over these practices (8).

Funding by the British Veterinary Association Animal Welfare Foundation (BVAAWF), the Agricultural and Horticultural Development Board (AHDB), Hybu Cig Cymru (HCC), Quality Meat Scotland (QMS) and the Biotechnology and Biological Sciences Research Council (BBSRC) has enabled researchers at the University of Liverpool to describe some of the fundamental aspects of this relatively new disease, including its aetiology (9, 10), epidemiology and risk factors for occurrence (4, 11), clinical presentation (12), animal welfare impact (13), pathology (14), transmission routes (15, 16), and treatment strategies (17-20) including the rational selection of antimicrobials based on in vitro (20) and in vivo antibiotic efficacies (17). Furthermore, a randomized control trial demonstrated that whole flock metaphylactic treatments with tilmicosin failed to eradicate CODD from flocks, thus providing evidence against this practice (19).

A key component of the research program was dissemination of the research findings to veterinarians and sheep farmers via knowledge exchange activities carried out in conjunction with AHDB and HCC. A broad range of activities were undertaken including presentations at national and international veterinary conferences, farmer knowledge
exchange meetings, on farm demonstrations, articles in the veterinary and farming press,
creation of industry manuals and contributions to policy and webinars.

It is essential that veterinary research has a beneficial impact on the communities on whose
behalf the research is being conducted. Therefore, the aim of this study was to 1) identify
the impact of this research activity and subsequent knowledge exchange activities on
improvements to the knowledge and practices of sheep farmers and veterinarians in their
management of CODD and 2) to identify the industry needs for future research on CODD.

Materials and Methods
Sheep Farmer Survey
UK sheep farmers were the study population for the farmer electronic survey. They were
contacted through the National Sheep Association, Sheep Veterinary Society email group
and social media networks of Facebook (www.Facebook.com) and Twitter
(www.twitter.com). A pilot survey was tested on 4 farmers prior to distribution of the final
questionnaire in May to July 2020. The questionnaire consisted of 14 questions. There were
2 questions on demographics, 9 questions on current knowledge and practices on the
diagnosis, prevalence, treatment and prevention of CODD and 2 questions on changes in
farming management practices that were a consequence of recent research information
and advice on CODD. There was one open question asking for farmers views and comments
on future research required for CODD. Farmers were asked to classify CODD lesions based
on a pictorial guide of key diagnostic features of CODD lesions. The electronic survey was
created and distributed through Jisc on-line survey tool (www.jisc.ac.uk). The project was
approved by University of Liverpool Veterinary Research Ethics Committee (VREC 936).

Veterinarian Survey
UK veterinary surgeons who treat sheep as part of their professional practice were the study population for the electronic survey. They were contacted through the Sheep Veterinary Society email group and social media networks such as Facebook (www.Facebook.com) and Twitter (www.twitter.com). A pilot survey was tested on 4 veterinary surgeons prior to distribution of the final questionnaire in July/August 2019. The questionnaire consisted of 7 questions. The first five addressed changes in veterinary surgeon knowledge and practices on the diagnosis, epidemiology and management of CODD as a direct result of the research conducted at the University of Liverpool. One open question asked for veterinary surgeon’s views on future research required for CODD and the final question was an open question asking for general comments on CODD research. The electronic survey was created and distributed through Survey Monkey on-line survey tool (www.surveymonkey.co.uk). The project was approved by University of Liverpool Veterinary Research Ethics Committee (VREC819).

Data Analysis

Data was downloaded from the survey into EXCEL (Microsoft, Washington USA) and analysed in Minitab (Minitab Ltd, Coventry, UK). Results are reported as proportions or medians plus interquartile ranges as appropriate.

Results

Sheep Farmer Survey

Two hundred and eighty four farmers responded to the survey with representation from England (65% of respondents), Scotland (10%), Northern Ireland (2%) and Wales (19%). The median flock size of respondents was 330 (IQR 130-655) breeding ewes. This is comparable to the UK average of 461 sheep per holding (21).
In total, 97% of respondents were aware of CODD as a disease, whilst 67% of respondents confirmed that they had identified CODD on their farm. Farmers were asked to estimate the prevalence of CODD on their farms when disease was at its worst and the reported median prevalence was 5% (IQR 3-15%). Farmers reported using a range of management strategies to attempt to control the disease in their flock (Figure 1A). For flock level control measures, the majority of respondents (90%) used prompt treatment of individual sheep with antibiotics, followed by culling chronically lame sheep (64%), hoof trimming when lame (55%), ensuring clean bedding (55%), and non-antibiotic foot bathing (50%). For treatment of individual sheep affected by CODD (Figure 1B), the most common treatment used was prompt injection of antibiotics (88%), followed by topical antibiotic application (77%) and foot trimming (47%). Thirty seven percent of farmers treated sheep with CODD with analgesics. Oxytetracycline (26%) and amoxicillin (25%) were the most common antibiotics used. However, when the macrolide drug group usage figures were combined, 35% of antibiotics selected by the farmers to treat CODD cases were from this class of antibiotic (Figure 1C).

Ninety three percent of farmers undertook some form of biosecurity measure to prevent CODD coming onto their farm, with 43% of farmers following current CODD specific advice to examine the feet of all bought in sheep on arrival. Seventy five percent of farmers isolated their bought in sheep on arrival for a median time of 21 days (IQR 14-28 days) (Figure 1D).
Figure 1: Farmer reported flock level control measures (A). Individual animal level treatments for CODD (B). Antibiotics used by farmers in treatment of CODD (C). Biosecurity measures employed by farmers (D).

In response to the question: - “My management of CODD on sheep farms has improved because of recent guidance on the disease (information may have come through vet advice or farming press or farmer meetings for example)?”, the majority of farmer respondents
(52%) agreed that their management of CODD had been improved (Figure 2A).

Furthermore, when asked “Which aspects of your management of CODD have been influenced by recent information on CODD (information may have come through vet advice or farming press or farmer meetings for example)?”, they stated that the key management areas impacted were biosecurity measures (46%), choice of antibiotic (52%) and the use of the footrot vaccine Footvax (MSD) (24%) (Fig 2B).
Figure 2: Impact of Codd research on farmer knowledge and practices. Percentage agreement of farmers with the statement that their management of Codd on sheep farms has improved because of recent guidance on the disease (A). Aspects of management of Codd that have been influenced by recent information on Codd (B).

Analysis of research priorities of both farmers and vets was conducted by grouping the answers into research themes. For the 176 farmers that completed this question, there were 305 responses, with the priority research areas identified as therapeutics (55%), vaccine development (26%), and disease transmission (24%) (figure 3).
Veterinary Surgeon Survey

There were 77 responses to the veterinary surgeon’s survey. No demographic data was collected. Participants were only asked to confirm that they treat sheep as part of their veterinary practice. In this survey, 73% of respondents considered their awareness of CODD had increased as a result of recent research, 60% of respondents considered their knowledge of clinical diagnosis and also the epidemiology of CODD had improved. Overall, 70% of respondents stated that their advice on the management of CODD had improved. In particular, advice on antibiotic use had changed with 45% of vets decreasing their use of whole flock antibiotic treatments to control CODD and 57% recommending to reduce the use of antibiotic footbaths. Research data influenced 73% of vets on their advice of antibiotic choice. For CODD prevention, 58% of vets had increased their prescribing of Footvax (MSD) and 63% of vets had changed their advice on biosecurity measures for CODD based on research findings (Figure 4).
Analysis of research priorities for vets was conducted as described for farmers. For vets there were 70 responses from 51 vets, with the priority research themes identified as vaccine development (31%), therapeutics (26%) and disease transmission (13%) (Figure 3).

Discussion

The aim of this study was to measure the impact of recent research on CODD on farmers’ and veterinarians’ knowledge and practice around the disease, and to identify where future research emphasis is needed.

Before consideration of the research findings, the limitations of the study should be considered to inform data interpretation and comparison with other studies. Firstly, the sampling strategy is a non-random, convenience sample based on UK sheep farmers’ and sheep vets’ ability to access, and then be willing to respond to, an electronic questionnaire. For example, the study population maybe be biased towards younger members of each
profession. The inevitable sampling bias means that these findings cannot be generalised
to the entire UK population of sheep farmers and veterinarians. However, the Sheep
Veterinary Society represents members of the veterinary profession from across the UK
with a particular interest in sheep, whose clinical practice involves a significant proportion
of sheep work, and the National Sheep Association is the largest, UK wide association for
sheep farmers. Furthermore, demographic data from the study shows that the farmers who
responded to the survey came from all devolved UK nations, in a similar distribution to the
UK sheep population (21). Finally, it is considered that the impact can be attributed to
recent research at the University of Liverpool. A search of the scientific literature on Web
of Science (22) (15/01/2021) found 17 scientific articles on the study of contagious ovine
digital dermatitis published between 2010 and 2019; 16 out of the 17 articles were
authored by the University of Liverpool researchers. Therefore, it is a fair assumption that
changes in veterinary and farming practice are as a consequence of University of Liverpool
research work. Therefore, the findings of the study can be considered a useful indicator of
the impact of CODD research work on UK veterinary practice and the sheep farming
industry.
CODD was reported as a common disease in this population, with 68% of farmers
reporting to have CODD at a median prevalence of 5% (IQR 3-15%) when CODD was at its
worst on the farm. The prevalence estimates reported here are higher than for previous
epidemiological studies. In 2013 in England, the on-farm prevalence of CODD was reported
as 2.3% (1), whilst in 2014 in Wales, it was reported as 2.0% (IQR 1.0–5.0%) (4).
Comparisons with this data should be interpreted with caution due to bias caused by non-
random sampling, different study populations, reporting bias by the farmers (the data is a
farmer estimate only and knowledge and awareness of CODD is likely to have increased
since this time) and differences in how the question was asked. Since CODD prevalence on
farms fluctuates temporally with some seasonality, in this study, we asked farmers to
estimate prevalence when CODD was at its worst which could account for the apparent
increase in prevalence. However, it is possible that despite improvements and changes in
knowledge and practices around CODD management discussed below, the prevalence of
CODD is increasing in the UK, and further research is urgently needed. The farmers and
veterinarians in the survey have given clear guidance as to where they think research
efforts should be focussed by identifying research on treatment strategies, development of
a vaccine and studies to understand transmission routes as their top three priorities (Figure
3).

Nearly all the sheep farmers in the study were aware of CODD, and 52% of farmers and 70%
of vets considered that their management of CODD had improved as a result of recent
research, demonstrating substantial dissemination of the research outputs in a relatively
short period of time since the majority of the work was published in the scientific press
(2014-2018). Importantly, the farmers and veterinary surgeons reported the main
improvements they had made as direct result of the University of Liverpool research was in
biosecurity practices (45% and 63 %, respectively), and antibiotic treatments (52% and 73%,
respectively) (Figures 2 and 4).

The findings on the farmer biosecurity practice improvements to prevent disease incursion
are particularly encouraging, as it is arguably the most important disease control measure
at the flock level. Nearly all the farmers (93%) had biosecurity measures in place to prevent
CODD introduction, the majority (75%) following best practice general industry advice to
isolate animals for 3-4 weeks (23, 24) and 43% following CODD specific advice to examine
the feet of all bought in sheep on arrival (1, 13) (Figure 1D).
As already indicated, concerns existed around the treatment of CODD in the early 2010’s when whole flock treatments with antibiotics, deemed critically important for human health, were being advocated, as well as antibiotic foot bathing. However, at that time little was known about the aetiology and treatment of CODD, and the severity of the disease and impact on sheep welfare was of concern. Research on CODD treatment has come a considerable way since then. We have investigated *in vitro* antibiotic efficacy (20), and undertaken two large scale randomized controlled field trials (17, 19). This data has been shared widely with sheep farmers and veterinarians such that 90% of farmers are treating sheep with the recommended prompt antibiotic treatment (Figure 1B), whilst 45% of veterinarians have decreased their use of whole flock antibiotic treatments and 57% have ceased or reduced recommendations to use antibiotic footbaths. Research data influenced 73% of vets on their advice of antibiotic choice (Figure 4). On farms, the farmers are using a range of antibiotic treatments (Figure 3), most of which (apart from oxytetracycline 34%) would be expected to be effective based on current evidence (20). Finally, both vets and farmers have taken up a number of CODD disease control measures that have emerged from the study of epidemiology and associated risk factors (11). For example, footrot has been identified as the major risk factor for CODD, with a vaccine efficacy of 32% protection against clinical disease (17). Encouragingly, 58% of vets increased their prescribing of the footrot vaccine, Footvax (MSD), to aid control of CODD (Figure 4). Whilst 34% of the farmers reported using Footvax (MSD) as a control measure for CODD in their flocks (figure 1A).

Although there were many positive findings in the study in the uptake of evidence based veterinary practice, there are some areas of concern. In particular, the common practice of foot trimming lame (55%) and non-lame sheep (14%) by farmers in this study (figure 1A).
Research evidence has identified that foot trimming is contraindicated in the treatment of footrot (26), increases the risk of lameness in flocks (27) and has the potential to spread disease (28) and is now not advised in the treatment of lame sheep (29). So, it is concerning that the practices are still relatively common amongst farmers.

Conclusion

The survey has shown that there has been strong uptake of recent evidence based veterinary medicine by farmers and veterinarians for the management of CODD, particularly in the areas of biosecurity and responsible antibiotic use. However, despite these positive efforts by the industry, there is evidence to suggest that CODD prevalence could be increasing in the UK and further research and knowledge exchange is required to tackle this. Farmers and veterinarians have identified their research priorities as treatment strategies, vaccine design and disease transmission.

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Authors’ contributions

JD undertook the original research and knowledge exchange activities on CODD, co-designed the current study and wrote the first draft of the manuscript. TW co-designed the current study, undertook data analysis and critically evaluated the manuscript, NFRS undertook data analysis. JWA, DGW, NJE and SC undertook the original research and knowledge exchange activities on CODD and critically evaluated the manuscript.

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**References**


Figure Legends

Figure 1: Farmer reported flock level CODD control measures (A). Individual animal level treatments for CODD (B). Antibiotics used by farmers in treatment of CODD (C). Biosecurity measures employed by farmers (D).
Figure 2: Impact of CODD research on farmer knowledge and practices. Percentage of farmers agreeing with the statement that their management of CODD on sheep farms has improved because of recent guidance on the disease (A). Aspects of management of CODD that have been influenced by recent information on CODD (B).

Figure 3: Farmer (n=176) and veterinary surgeons (n=51) opinions on future research priorities for CODD.

Figure 4: Changes in veterinary advice on management practices for CODD.